UNIVERSITY OF MALAYA



# Interactive Multimedia Educational Games

## Science Module

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**FINAL YEAR PROJECT REPORT II**

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## Abstract

For the past three months my partner and I has studied the design and use of educational games for mathematics and science education in ages 9 to 12. Our research about "Interactive Multimedia Educational Games" has involved lecturers and course mates in Faculty computer science and information technology, teachers and some of the children. The outcomes of this collaboration will be included a wide range of research studies as what we had done. Efforts are put to ensure that games can be very effective in increasing both motivation and achievement in mathematics and science learning.

The thesis title was chosen as "Interactive Multimedia Educational Game" because of their appeal to children and because they offer excellent opportunities for visualization and exploration of some concepts. I will develop the educational games for Science module while my partner will develop the Mathematics module. One of the objectives of this game is to help teachers in teaching Science in English and to help the students to understand the subject more effectiveness.

Lastly, I do hope this "Interactive Multimedia Educational Games" were effective in enhancing mathematics and science learning for purposes beyond memorization drills. Also, can serve to enable children enjoy themselves throughout the playing and learning process, and to achieve the specified objectives.

## Acknowledgement

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# Chapter 1: Introduction To The Project

## 1.1 Introduction to Project

This project is about to develop games that could be used to support learning in science education. There will be a combination of mathematics and science educational games at the end of the system development. These conceptual prototypes are designed to:

i. Influence upon the innovation in next-generation educational gaming.

ii. Provide concrete models of state-of-the-art educational gaming.

iii. Suggest a range of gameplay experiences to expand notions of educational gaming.

iv. Be candidates for future development.

Many critics argue that games produce socially isolated people or promote violent behavior. Games are simple, mind-numbing entertainment. Playing games is a waste of time. Some of these criticisms may (or may not) be true, but to view all game-playing through this lens is to ignore the broader history of games and the diverse range of game-playing experiences available.

What's missing from contemporary debate on gaming and culture is any naturalistic study of what game-playing experiences are like, how gaming fits into people's lives, and the kinds of practices people are engaged in while gaming. Few, if any researchers have studied how and why people play games and what gaming environments are like. The few times researchers have asked these questions, they have found surprising results. In 1985, Mitchell gave Atari 2600 consoles to twenty families and found that most families used the game systems as a shared play activity. Instead of leading to poor school performance, increased family violence, or strained

family interactions, video game were a positive force on family interactions, "reminiscent of days of Monopoly, checkers, card games, and jigsaw puzzles" [Mitchell, 1985, p.134]. The most under-examined potential of games may be their impact as an educational medium.

## 1.2 Aim of the Project

This project aims to set and effective learning tool for children and increasing the proportion of children in Grades 9-12 who enjoy learning and exploring concepts in mathematics and science. The age range of 9 to 12 was chosen because this is when most children lose interest in these subjects. The goal is to find game formats that are attractive to students and, at the same time, are suitable for learning particular concepts. As a conclusion, this project aims to give education a step further in learning and teaching for primary school in order to preparer them for greater challenge in secondary school.

## 1.3 Project Objectives

The main objectives of developing this project are

i) Enable students to

- Understand, interpret, and make use of scientific information posed in various styles.
- Solve problems in various situations.
- Analyze, synthesize, evaluate and think about ideas and information logically and critically.
- Know handling techniques and various aspects of scientific equipment safety.

- Instill proper values and attitudes in the learning and practice of science.
- Be more computer literate.

ii) To design and develop a CD-ROM based multimedia learning and teaching science for primary school.

iii) To design and develop an attractive and interactive interface application to make this CD user-friendly to students as well as teachers and parents.

iv) To give a new approach in education from the traditional method that can make education fun learning and enjoyable in Malaysia.

## 1.4 Project Scope

This project will be developing on Windows Platform and the project will cover four of the science topic from categories animal, weather, Earth Science Elements and Health.

The language that will use in this project is English regarding the introduction of the teaching of Science and Mathematics in English be confined to Year One, Form One and Lower Six next year.

The project is developing suitable for people who are:

i) Students from primary three to primary six or aged between 9 to 12 years old. It is mainly designed to educate the students from where primary school before they get in touches with science the secondary schools.

ii) Teachers who are teaching primary schools. It can be a teaching-tool for the teachers to guide the students in advanced about science.

iii) Parents with children studying primary school. Parents will help their children to be more intellectual and interest in studies.

The assumptions that are made are:

i) There is a personal computer with a CD-ROM drive that makes use of offline delivery.

ii) Students, parents, and teachers are computer literacy. If one cannot understand how to use a personal computer, it is very hard for them to learn and play the game from this CD.

## 1.5 Schedule

To achieve this project's objectives, a project schedule is highly needed to plan and schedule the tasks properly according to a certain period of time so that the needed activity that is to be done can be accomplished within the certain time frame. Thus, it will help to systematically organize the project. A Gantt chart is used to schedule tasks.

A Gantt chart is a method used to help define the breakdown of the project into tasks and sequence of tasks that need to be performed according to a time line.

| Month | June | | | | July | | | | August | | | | September | | | | October | | | | November | | | | December | | | | January | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Week | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Feasibility Study | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Definition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Analysis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Design | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Report | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coding | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Documentation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Testing and Review | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Presentation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 1.1: Project schedule Gantt chart

## 1.6 Expected Outcome

This project is expected to impart knowledge of science to the children in four different topics. Besides that, it will give the children a touch of sciences through interactive multimedia method and be more computer literate. Due to time constraint, the syllabus that will be using for this educational science game will be very basic as introduction to the world of science.

It is also expected that this system learning can give a reliable and user friendly environment so that it can easily handle by the user.

# Chapter 2: Literature Review

## 2.1 Introduction to Literature

Literature review is a background study about the knowledge and information gained during the project's development. It is a process of assembling the information about the project and its development. The purpose of this literature review is to gain a better understanding on the development tools that can be used to develop a project and also get a better knowledge on the development methodologies used while developing a project.

During the project development, I have been searched and analyzed several references, related articles and examples of previous thesis and also to understand and recognize the existing interactive multimedia learning and teaching that are available in the market, current information system and E-learning package. To ensure the proposed system will be a better system compared to the existing system, investigation and analysis of all these information are very important. It will also avoid repeating and carrying the weakness of the existing application to the proposed system.

## 2.2 What is Multimedia?

Multimedia is the seamless integration of text, sound, images of all kinds and control software within a single digital information environment. [Tony Feldman, multimedia consultant]

The definition applies to interactive media productions for distribution both online, such as Web pages, and offline, such as kiosks and CD-ROM.

An offline project is self-contained, does not interact with anything outside its immediate environment, and usually communicates with nothing outside the computer it runs on except for the user. An online project needs to communicate with distant resources and sometimes distant users. Some projects have elements of both on- and offline projects, and will refer to these as hybrid Web/CD projects.

A project in multimedia comprises a series of tasks that deliver a combination of media and have a computer component to integrate them. There are software development projects that combine media components into an application to run on a delivery platform. The delivery platform will be one that can support an interactive combination of video, graphics, animation, sound and text. This could include anything from the Internet to interactive TV. [1]

### 2.2.1 Why Multimedia Learning Style

Human beings have the natural ability to understand the information presented in the form of speech, photographs, or video sequences. Multimedia can accommodate different learning styles. Some students learn better through association, others by experimentation; some are more visually oriented and others are more auditory multimedia can present material in the way we think – in a manner that is nonlinear. It let us review specific aspects as often as we like, skipping around as necessary. It is navigating, as it allows the user to take change of his or her learning. Multimedia can provide feedback, adjust the level of differently, and evaluate skills. And it can make learning fun. [James E.Schuman, Multimedia in Action]

### 2.2.2 Multimedia Elements

Multimedia is comprised of several elements including text, graphics, audio, video, and animation. Following are brief explanations of each multimedia element and how they can be used:

**Text**

Text is perhaps the most fundamental element of any multimedia project. The value of text tends to be overlooked by multimedia specialists, but it is an integral part of any needs to be thought as carefully as the other media components. It is used extensively in online but less so in offline; care should be taken to keep its quality in line with other media components. [U2]

**Graphics**

Computer graphics are versatile and can range from simple line drawing to 3D animations. The strength of graphics is to provide a visual stimulus that can trigger reaction in the user. It can be the prime source of the reaction, or can offer support for other media components so that their impact is improved [U2]. They can offer realistic and symbolic representations. They handle transformations between layers of visuals well, for example, skin and bones.

**Audio**

Audio is a versatile medium, which will usually be an integral part of any video but can be used alone or to accompany graphics, text, or both simultaneously. Audio includes speech, music and sounds. It can save the overuse of text when this is an option. It appeals to the emotions. Its range and scope are unappreciated to date. Care is needed to avoid sounds that become irritating when repeated in an interactive environment. [U1]

**Video**

Video is already a combined medium because it generally uses sound to accompany the pictures in some form. The display size of any video needs to be appropriate for the content, the needs of the viewer, and the method of distribution. Video uses more space and/or bandwidth than other media, and many affect the interaction speed. Video use for education and training has extra considerations from research. [U1]

**Animation**

Graphics that contain movement are often referred to as animation. Animations are kept simple enough to be understood, but sufficiently complex the important information. Animations were found to be good for representing motion, trajectory, spatial organization, and otherwise invisible events, but their overuse can be distracting.

### 2.2.3 Advantages and Disadvantages of Multimedia

There are many ***advantages*** why choosing multimedia way of learning been applied in this project:

- Through many researchers and through analysis by wide range of people, multimedia proves as mirrors the way in which the human mind thinks, learns and remembers by moving easily from words to images to sound, stopping along the way for interpretation, analysis, and in-depth exploration.
- Multimedia has a chameleon – like ability to pretend to be many things. In designing an application you have the freedom to use many disparate media types and techniques.
- The combination of media elements in multimedia lessons enables children to learn more spontaneously and naturally, using any sensory modes they prefer.

For instance, they are people who can learn better through seeing, others may find it easier to learn through seeing and hearing. Still others learn best through manipulation kinesthetic (tactile) exercises.

- By combining all the media elements with well-designed, interactive exercises enables learners to enhance their learning and experience through self-discovering. This will enable them no longer passive while information is "spoon-feeding" to them.
- Program that are designed sometimes do allow feedback in order to clarify misconceptions before trainees become confused and to provide direct reinforcement for correct responses. As you can see, this will enable them to be more analytical and active in learning.
- Putting the words with pictures, graphics, and audio, multimedia programs enable people with varying levels of literacy to learn by using sight, hearing and touch. Evidence proves that using multimedia segments as context for students significantly aids in reading comprehension.
- Looking back, students from the pass may only raise their hands to ask a question so many times. But now, many multimedia programs (expert system) are designed to allow learners to pause, branch, or stop for further remediation, exploration, or enhancement opportunity. These interactive qualities encourage non-linear thinking.
- With a multimedia program, learners can get more individualized attention from their teacher, as they read it most.
- Teachers now have more time to focus on activities that demand participation while students are able to learn on their own.

Of course, everything in this would have their pros and cons. Multimedia also has it own ***disadvantage***. Below are some recognized disadvantages of multimedia:

- To run a multimedia, user need high processor speed, memory, disk space, and data throughput.
- The elements like sound, images or animation, and video require higher bandwidth than text files because of the size.
- The disciplines of multimedia are as diverse as the media types. Familiarity and expertise are required in all facets of facility with computer software.

## 2.3 An Overview of CD-ROM-Based Learning

CD-ROM based learning (a major subcomponent of the broader term "e-learning") is one of the tools with which education is delivered. In traditional academic institutions, CO-ROM-based learning systems are generally housed administratively in a "distance education" department alongside other at distance delivery methods such as correspondence, satellite broadcast, two way videoconferencing, and videotape delivery system. All such system seeks to serve learners at some distance from their learning facilitator. Many such systems attempt to serve learners interacting with the learning source at different chronological times (for example, email). Distance Education, then is often referred to as those delivery modalities that seek to reduce the barriers of time and space to learning, thus the frequently used phrase "anytime, anywhere learning".

### 2.3.1 Definition of CD-ROM-Based Learning

The simplest definition of interactive CD-ROM-based learning is the delivery of interactive training or education which is also known as computer-based training. It is

the structured transfer of skill or knowledge that takes place by using an interactive CD. The way this interactive learning is designed and implemented varies greatly. A full service learning community offering will likely have to support many approaches to interactive CD learning design and delivery.

The varieties of interactive CD-based learning are usually defined by the technology used, or by the approach to learning that the technology supports. This briefly primer describes a number of scales that can be used to characterize and evaluate integrated CD-ROM Learning Environments on the market. There are broad categories typically used to define the main functionality of CD-ROM-based learning. In the past integrated CD-ROM Learning Environment (CDLE) products would clearly fall on one or the other side of these categories. More recently CD-ROM's are becoming multi-functional and often fall somewhere in the middle of a continuum.

## 2.4 Introduction to Authoring Systems

### 2.4.1 Definition

Hypermedia authoring system is a type of development environment designed to empower developers and development teams to produce various types of multimedia applications. It can be assembled in three parts: hardware and operating system, the authoring system software and special-purpose utilities that may supplement the hypermedia authoring systems [Shi Tao, V.D.Dinh]. [U3]

### 2.4.2 Authoring in the development process

Developing of hypermedia product is the process of reorganizing, restructuring and representing of information. It includes requirements analysis, specification, content obtaining, designing, authoring and publishing. Authoring is the major part in the development process, which, in essential, involves four steps: the structuring existing

information, combing different types of media, and designing the screen layout. The structuring entails dividing information into nodes, chunking information segments, identifying key concepts and linking related concepts [Shi Tao, V.D.Dinh]. [U3]

### 2.4.3 Authoring approaches

Based on authorized hypermedia systems, authoring systems have three main approaches: Programming Language Approach, Screen based approach, and Information centred approach [D.Lowe, 1996]. [U3]

**Programming language based approach**

In the past, hypermedia applications were created by using programming languages such as C or C++. This approach is suitable for developing a high performance hypermedia information system. Because applications are coded, like any software system, it is very time consuming and codes can not be re-used. The author's programming skills and system knowledge are highly demanded in order to deal with both hardware and software performance.

**Screen based approach**

This approach is based on graphical views on screen to develop a hypermedia application so that the content of the application is described by the screen layout. It can be classified into different paradigms such as the Iconic/Flow Control, Frame, and Card/Scripting.

***Iconic/Flow Control paradigm***

This tends to be the speediest authoring style; it is best suited for rapid prototyping and short-development time projects. The main idea of this paradigm is the Icon Palette, containing the possible functions/interactions of a program, and Flow line, which shows the actual links between the icons. These authoring tools tend to be the

slowest run-times, because each interaction carries with it all of its possible permutations.

***Frame paradigm***

Frame paradigm is similar to the Iconic/Flow control paradigm in that it usually incorporates icon palette; however, the links drawn between icons are conceptual and do not always present the actual flow of the paradigm. This is a very fast development system, but requires a good auto-debugging function, as it is visually un-debuggable.

***Card/Scripting paradigm***

The Card/Scripting paradigm provides a great deal of power (via the incorporated scripting language) but suffers from the index-card structure. It is well suited for developing hypertext applications. The best applications allow all objects to be scripted; many entertainment applications are prototype in a card/scripting system prior to compiled-language coding.

Many of the currently available professional authoring system are screen-based. Although this approach allows authors to think and create units of information in screen or frame sized units, it is also time consuming because existing written information does not always translate easily into screen-sized unit and each screen including content and layout has to be designed individually. This requires significant reformatting of materials, and considerable combination of knowledge and skills is needed, such as database management skills, hypertext/hypermedia rhetoric and analysis skills as well as interface design skills [Horn, 1989].

**Information centred approach**

In this approach, authors can use existing information or create it if not available. This information is then processed and saved in a database. The processing procedure involves dividing information into nodes and identifying key concepts. Next, the

related concepts are linked. Then the way of presenting information on the computer screen is defined. Information centred authoring systems do not impose the same restrictions on node size as screen-based systems and thus can be easier to convert to. The authoring process can be optimized as the structuring, linking of information and designing of screen layout are separated into different phases which can be carried out respectively by different authors with specific expertise.

### 2.4.4 Features of Authoring Systems

There are an ever increasing features contained in current authoring systems to meet the demands of hypermedia application. Although these features are great variation across systems, most of them can be classified in terms of three parts of authoring system. [Berk, 1991]. [U3]

One part of authoring system is authoring platform which includes hardware and operating system. It provides abilities such as of gatewaying into other applications or information systems, exchanging information with external programs.

The basic feature of authoring software system is the rang of editing functions available. Many authoring systems have built-in browser for previewing during authoring and navigating in reading hypermedia products. In addition, authoring metaphors, importing and exporting capabilities as well as storage facilities concerns the way and capabilities of dealing with raw information.

In addition, certain special-purpose utilities are specific to, and required for, efficient hypertext authoring such as functions of node and link listing, keyword searching and indexing. These utilities may benefit and assistant author during the authoring process.

### 2.4.5 Multimedia Authoring Tools

Multimedia authoring tools make it easier to create full scale multimedia projects. Fortunately, there are assortments of tools available to choose from.

***Macromedia Authorware 6***

Authorware 6 Attain is the leading visual rich-media authoring tool for creating web and online learning. With it user can solve mission-critical training challenges.

Authorware provides the tools that need to:

- Create highly interactive, rich-media learning applications
- Deliver to employees and customers on the web, LANs, and CD-ROM
- Track student progress and results

***Macromedia Director 8.5***

Macromedia Director 8 Shockwave Studio is the world's foremost authoring tool for creating interactive multimedia. Developers rely on Director to create attention-grabbing business presentations, advertising kiosks, interactive entertainment and educational products.

Users can view completed Director Movie over the Internet, either in a Web browser or independent of a browser, or as a stand-alone projector suitable for LANs and distribution through CD-ROM and DVD-ROM.

***Macromedia Flash 5***

Flash can be used to produce animations, menu systems, games and a lot more, in using files small enough to be used on a website. The new features in Flash 5 provide enhanced capabilities for creating artwork, streamlining workflow, and creating interactivity. Flash 5 also includes greatly expanded capabilities for creating actions with ActionScript. [U4]

***Adobe Photoshop 6.0***

Photoshop is a very powerful digital image manipulation package with various functions including image enhancing, resizing, montage, colour retouching and colour correction all of which can be used individually or combined for a specific effect. Photoshop can be used to simply scan and correct an image or get more creative by compositing and adding special effect.

***Adobe Illustrator 10***

Adobe Illustrator is a professional quality graphic art program. Its applications are diverse, from creating print to web graphics and posters. Although the program is complex and requires a significant amount of time to truly master, it is quite easy to learn the basics and create work with a professional appearance.

***Adobe InDesign 2.0***

Adobe InDesign is built very differently from any other desktop application. There's a small core program file; all additional required resources are stored separately in code libraries, and extensions to InDesign are installed by simply dragging them to the InDesign Plug-ins folders. It's an interesting and efficient means of program design and it makes updating and upgrading a simple operation of replacing an old plug-in with a new one.

### 2.4.6 Programming and Scripting Language

Programming language is an artificial language that is used to generate or to express computer programs. Scripting language is a programming language supported by and specific to a particular program. [U5]

***Java***

A programming language introduced by Sun Microsystems. Java is a multiplatform, platform-independent, object oriented programming language. Java programs are not compiled, but rather interpreted as run. [U6]

***Javascript***

Javascript is a hypertext language that will allow programmers to make page a lot more interactive without using a bunch of complex coding. Javascript can interact with HTML source code, enabling Web authors to spice up their sites with dynamic content. [U7]

***Visual Basic***

Visual Basic (VB) is a RAD (Rapid Application Development) tool, which allows programmers to create Windows applications in very little time. It is the most popular programming language in the world, and has more programmers and lines of code than any of its nearest. [U8]

***Visual Basic Scripting***

VBScript is a subset of the Visual Basic Programming language. The result of the slimming down process is a very small language that is easy to use. There is also available Visual Basic for Applications (VBA) for use with Microsoft Word, Excel, Access etc. [U9]

***ActionScript***

Flash 5 ActionScript contains features for creating immersive, interactive Web sites with sophisticated games, forms, surveys, and real-time interactivity such as chat similar to the core JavaScript programming language.

*Lingo*

Lingo, Director's scripting language, adds interactivity to a movie. Lingo can accomplish many of the same tasks, such as moving sprites on the Stage or playing sounds that user can accomplish using the Director interface. Instead of playing a series of frames exactly as the Score dictates, Lingo can control the movie in response to specific conditions and events. Lingo provides an alternative way to implement common Director features; for example, user can use Lingo to create animation, stream movies from the Web, perform navigation, format text, and respond to user actions with the keyboard and mouse.

## 2.5 Existing Games System

There are several similarly multimedia learning packages that could found at Internet. Besides that, available software in the market also have been searched and observed. These found packages are useful since it can be used as main resources for reforming any ambiguities that arise during the process of developing.

### 2.5.1 www.funbrain.com

FunBrain.com is an educational game-based learning website. The system divided into three main parts; there are Kids & Games, Parents and Teachers. [U10]

i) Kids & Games

The categories that are available in this section are Game Showcase, Numbers, Words, Universe, Culture and Extra. The users can choose the games they like to play according to the subject they interested and their age range. The games can use to test the user's knowledge, develop their brainstorming and to be more computer literate.

ii) Parents

Parents are also given the opportunity to participate in the children's educational games. Here, parents are able to find the games that are suitable for their children to play. Furthermore, this system also provides some games that let parents to play games together with their children in Parent-Kid Challenges section.

iii) Teachers

Teachers are available to design their own paperless quizzes to their class. Quiz Lab automatically grades the quizzes and emails the results to the teachers. Besides, teachers are given the opportunity to access thousands of assessment quizzes written by others teachers. Before using all this options, teachers are required to register to become the member of the system first.

**Analysis and Comments**

i) The system covers various subjects and topics for a wide age group. All the games are listed in several categories that let users to find the games they like to play easily. The layouts are user-friendly and easy to use.

ii) No teaching lessons and tutorials are provided. The system expects users already have the knowledge to play the games.

### 2.5.2 Science Explorer II (CD-ROM based learning)

Science Explorer II is a highly visual and interactive CD-ROM designed to provide pupils with educationally sound and highly motivating opportunities to explore the principles of science in the context of the real world.

Features that are available in this CD-ROM included:

i) Six virtual laboratories provide opportunities for children to explore topics on human beings, living things, electricity, light, sound, materials, forces and motion, and Earth in space, through 18 interactive investigations;

ii) Slideshow and multimedia pages provide in-depth information;

iii) Illustrator scientific facts, including useful information on scientific equipment;

iv) Quizzes test knowledge;

v) A 'lab book' enables pupils to write up the results of their investigations;

vi) 'Guidebook' that acts as 'help' menu that available throughout users visits and includes a Guided Tour of the base;

**Analysis and Comments**

**Advantages:**

i) Each topic is presented in text with graphics added in simple and easy way to understand.

ii) 3D environment to attract users to explore the CD-ROM.

iii) User must login while the first entry to the system. When the next entrance, the system can detect that whether the user are new or existed. If the user already existed, whether the user want to continue where the user finished last entranced or to start a new visit.

iv) There are quizzes to test the user's knowledge after exploring the topics in this CD-ROM. This can ensure the users more understand the lessons that they had learned.

**Disadvantage:**

i) In the Catalogue menu, all the topics are not listed by main categories. This will confuse the user where the topics actually belong.

ii) There is no 'Exit' button in each of the screen except in the main screen before the user enter to the CD-ROM. User cannot quit the system in any time when they want to stop navigating the CD-ROM.

## 2.6 Introduction to Educational Games

"The fundamental deficiency of the school system is its failure to motivate the youth of the country to want to learn." [Introduction, Gordon, 1970]

It is no secret that motivation is one of the keys to education. Thus, it is a logical step to try to take advantage of the intrinsically motivating nature of electronic games by using this medium for educational purposes rather than simply for pure entertainment. The idea of producing educational games is certainly not new; it was one step behind the advent of electronic games themselves [Malone, 1981, 1982; Gentner, 1990; Nawrocki and Winner, 1983; Lepper and Chabay; 1985; Reynolds and Martin, 1988]. Educational games, sometimes called "edutainment" [Lepper and Chabay, 1985], represent the fastest-growing type of software [Consumer Reports, 1995].

The distinctions of whether games are to be used in a stand-alone manner or integrated into the curriculum and whether games are to be used in school or outside of school have not received sufficient attention in research to date. Butler [1988] and Randel *et al.* [1992] have both conducted literature reviews on the effectiveness of

educational games and simulations using the threshold of traditional classroom teaching as a measure of success. Butler's findings are quite broad and he doesn't provide the source for his findings. The findings of Randel *et al.*, on the other hand, are more specific and they provide the source and the methodology that was used in reaching their conclusions. Butler found that when games are used:

1. students generally acquire at least equal knowledge and intellectual skills as they would in other learning situations,
2. information is learned faster than in other methodologies although the amount learned is not significantly greater than with other methods,
3. students of low academic ability often improve their academic performance because of greater interest,
4. problem solving ability increases,
5. students will be motivated to participate in the activity, but their interest in the subject may not be improved, and
6. the tendency for students to attend school regularly increases.

Randel *et al.* performed a very strict review of studies reported in the literature and ignored the results of those studies for which the methodology was determined not to be scientific. They included studies based on games that were both electronic and non-electronic. 68 studies were examined directly or indirectly (through reviews conducted before 1984). A summary of their findings is reproduced almost verbatim here:

1. 38 (56%) studies found no difference, 22 (32%) found differences favoring simulations/games, 5 (7%) favored simulations/games, but their controls were questionable, 3 (5%) found differences favoring conventional instruction.

2. Seven out of eight studies involving math found that the use of games is superior to traditional classroom instruction for improving math achievement. The one study in physics was also favorable. Subject matter areas where very specific content can be targeted and objectives precisely defined are more likely to show beneficial effects for gaming. Games may also be effective in drill and practice situations with numerous highly related instances.
3. The greatest number of studies on simulation/gaming is in the area of social sciences. The majority of these studies (33 out of 46) showed no difference in student performance between games/simulations and conventional instruction.
4. Five out of six studies demonstrated that games could teach language arts effectively, particularly when specific objectives are targeted.
5. Social science simulations/games tend not to use a computer, while math, physics, and language arts games tend to use a computer.
6. Simulations/games show greater retention over time than conventional classroom instruction.
7. In 12 out of 14 studies, students reported more interest in simulation and game activities than in more conventional classroom instruction.

In general Butler's and Randel's findings indicate that games and simulations can be equally as good as or better than traditional classroom teaching. The fact that some of the literature reports the success of educational electronic games in an anecdotal or ad hoc manner and others use more formal methodology results in some disagreement in the literature on the effectiveness of games.

Some teachers, parents, and educational researchers argue that children are no longer motivated to learn. They contend that rote learning and textbook activities are practices of the past and that it is time to inject new learning structures into the

classroom. Educators must question what children are learning and how they are learning it [Joanna Lynn McGrenere, 1996].

The technology itself might first catch the eye of the visitors, they would in time, being teachers, be struck by the level of intellectual effort that the children were putting into this activity and the level of learning that was taking place, a level that seemed far beyond that which had taken place just a few hours earlier in school. The most open and honest of our time-traveling teachers might well observe that never before had they seen so much being learned in such a confined space and in so short a time [Papert, 1993].

Educational games have nonetheless been the entryway for children into the world of computers, empowering children to test out ideas about working within prefixed rules and structures in a way few other toys are capable of doing, have proved capable of teaching students about the possibilities and drawbacks of a newly presented system in ways many adults should envy. There has been a move to capitalize on this interest and motivation by introducing games containing traditional educational content into the classroom.

### 2.6.1 Designing Educational Electronic Games

There are numerous issues involved in the design of educational electronic games. A designer of games would need to ask a number of questions before diving into any production. These questions should include: What is it about electronic games that make them so motivational? Does this motivation persist when the games take on an educational flavor? What role does computer technology play in the classroom in general? What design principles exist for educational software?

Reynolds and Martin [1988], Brody [1993], Quinn [1994], and Kelly and O'Kelly [1994] have been documented the design guidelines. They include:

i) provide a clearly stated educational objective and content;

ii) provide prompt feedback on performance and progression;

iii) provide gaming interactions that facilitate the mastery of the objective;

iv) provide mechanisms for correcting errors and improving performance;

v) provide positive reinforcement that is appropriately timed;

vi) provide underlying pedagogical support; and map learning activities to interface actions and map learning concepts to interface objects.

In addition, Sedighian and Klawe [1996] argue that educational games should be designed to promote reflective cognition of the players.

### 2.6.2 Observations and findings

Below are the observations and findings should be viewed collectively as a set of synergistic factors that affect children's learning of mathematics and sciences and not considered in isolation [Kamran Sedighian]:

1) *Meaningful learning:* Computer games are an integral part of children's popular culture [Provenzo, 1991]. Situating mathematics and sciences learning in a computer game environment brings greater relevance to the subject for children. In interviews with children many of them made comments such as "if you're doing it [mathematics] out of a book it's really boring, and you don't want to do it," whereas, "if you're doing it out of a game or something then you're wanting to do it and you're having fun with it so you can concentrate on what you're doing instead of just getting it over with and then forgetting about it 5 minutes later."

2) *Goal:* Oftentimes provide children with a goal or a set of goals to achieve such as to finish the game or, as children put it, to "beat the game." We have noticed that such goals create a sense of mission in children. Many children expressed that they enjoyed the games because there is a "goal that you've got to accomplish something and then you get excited after you've accomplished it" and that with a goal "you have something to look forward to."

3) *Success:* Accomplishing the goals of games can provide children with a sense of success. Many students playing games keenly kept track of their score and how far they had advanced in the game as measures of their success. A particularly interesting instance was when some slow-paced students became very excited upon reaching a score of 1000. Their excitement was not because their score was necessarily high compared to other students or that they had gained a sense of the scoring scheme of the game, but simply because 1000 was a large number to them and therefore signalized success.

4) *Challenge*: We would often hear children say: "I like the challenge." as they played games. To almost all of them being challenged in a game meant that they would not be bored. Research found that the degree of challenge children asked for corresponded to their individual abilities; they needed to face a challenge, but not one that was beyond what they could handle. They particularly liked games that would progressively become more challenging. They often became quickly bored with activities within games which were repetitive. As they mastered a certain level of difficulty, many children would want to immediately move on to a new challenge. Children need to be constantly challenged and seem to thrive on it. They enjoy learning in the context of a fun challenge.

5) *Cognitive artifact:* There are two factors which made games a cognitive artifact for children, which are interactivity and communication. Many students commented that they enjoyed the fact that they could interact with the learning subjects in games. This interactive learning process helps children develop a sense of the subjects they are learning.

Educational games also provided students with a concrete, external reference point by which they could communicate their thoughts. Children need such cognitive artifacts to motivate and allow them to express their thoughts in learning subjects, even if this expression is initially game-bound.

6) *Association through pleasure*: Children need to associate learning subjects with some pleasant memory. This association assists the concepts to remain with the children. One of the students articulated this point when he made the following comment on how he remembers the mathematical concepts in one of the games:

> *"You think about the sound and then you remember the game and you remember what you were doing in the game and it can help you. Or if you're doing a math problem and you don't know how to do it with like a math book because it's boring, but then you played it in a game and you remember it from say the color or sound just comes up in your mind and you can go 'Yeah, that's how you do it!'"*

7) *Attraction:* Educational games can create environments in which children get excited about the embedded learning subjects and, therefore, are willing to be immersed in it and spend time learning it. In order to stimulate children to intensely think about learning subjects, they need to be put in learning environments which attract them and allow them to experience the joy of learning it.

8) *Sensory stimuli:* Several of the computer games which we installed for the children had minimal sensory stimuli. Many children were not particularly approving of these games because they had no fancy graphics, their images were in black and white, their animations were very simple, their sound effects were primitive, and they had no background music. We have found that for children such sensory stimuli add to the fun of playing the game and make the learning subjects more enjoyable and memorable.

# Chapter 3: Modeling the process and life cycle

## 3.1 The Meaning Of Process

A process is a series of steps involving activities, constraints, and resources that produce an intended output of some kind. A process usually involves a set of tools and techniques and has the following characteristics [2]:

- The process prescribes all of the major process activities.
- The process uses resources, subject to a set of constraints (such as a schedule), and produces intermediate and final product.
- The process may be composed of sub-processes that are linked in some way. The process may be defined as a hierarchy of processes, organized so that each sub-processes has its own process model.
- Each process activity has entry and exit criteria, so that we know when the activity begins and ends.
- The activities are organized in a sequence, so that it is clear when one activity is performed relative to the other activities.
- Every process has a set of guiding principles that explain the goals of each activity.
- Constraints or controls may apply to an activity, resource, or product.

When the process involves the building of some products, it is referred as a life cycle. A system development usually involves the following stages.

- Requirements analysis and definition
- System design
- Program design
- Writing the program (program implementation)

- Unit testing
- Integration testing
- System testing
- System delivery
- Maintenance

Building process model and discussing its sub processes help to understand what should be and what is. There are several reasons for modeling a process:

- It forms a common understanding of the activities, resources, a constraints involved in a system development
- Helps to find inconsistencies, redundancies, and omissions in the process and in its constituent parts. As these problems are noted and corrected, the process becomes more effectives and focused on building the final product.
- The module should reflect the goals of development, such as building high-quality system, finding faults early in development, and meeting required budget and schedule constraints.

Every development model includes system requirements as input and a delivered product as output.

### 3.2 Proposed development model for Interactive Multimedia Educational Science Games

To develop an Interactive Multimedia Educational Games for Science module, the model chosen is a combination of the waterfall and model and the prototype model. [2]

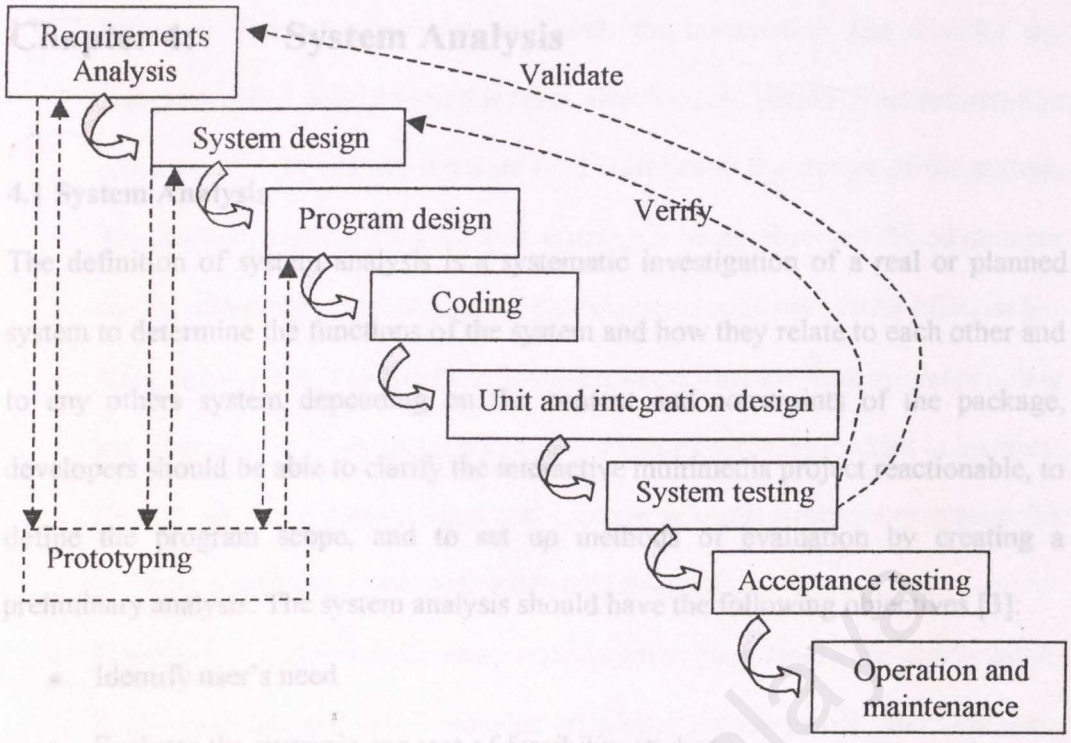



Figure 3.1: Waterfall Model with Prototyping

In a waterfall model, each development stage has to be completed before proceeding to the next. For example, in the first stage all the requirements are elicited, analyzed and documented before designing the system. Overall, the model in a well documented process. With the addition of the prototype model as the sub-process, contain aspects of the system can be reviewed and tested to check its functionality and whether it meets the specific requirement yet possibly changing needs of any application. This way, major problems can be avoided as errors can be detected at early stage.

# Chapter 4: System Analysis

## 4.1 System Analysis

The definition of system analysis is a systematic investigation of a real or planned system to determine the functions of the system and how they relate to each other and to any others system depending on the context and constraints of the package, developers should be able to clarify the interactive multimedia project reactionable, to define the program scope, and to set up methods of evaluation by creating a preliminary analysis. The system analysis should have the following objectives [3]:

- Identify user's need
- Evaluate the system's concept of feasibility studies
- Perform economic and technical analysis
- Allocate functions to hardware, software, people, database and other system.
- Create a system specification definition that describes the functional and non-functional requirements.

### 4.1.1 Information Gathering Methods

This refers to the methods that are used to gather information regarding a system. It is necessary to employ the fact-finding techniques in order to establish understanding of the state and future requirements. The techniques used to obtain the needed information are:

- **Printed Resources**: Material like journals let me have a better understanding the capabilities, feasibility and the possibilities on how the system should be designed to give the best of it. Reference books and magazines were read to get information and a clearer picture how the system should be developed. Besides that, past year's thesis were referred too.

- **Internet**: The main resource to search for information and to refer any ambiguities that arise during the entire development period. Vast information could be found from the software of the system to the design of the system. Besides that, existing sites for kids learning is being observed the advantages and disadvantages. This will be my guideline to design my system effectively.
- **Kids Software in The Market**: There are many kids software available online and distribute in CD-ROM. I had a play with this software for kids in learning. Here, I can have a better idea and creative in implementing my system for children in educating them with more effectiveness.
- **Interview**: An informal intention interview was done among my course mate, family and my relatives. Resources on what software to use, and why were asked through their own experience of using the software. Having an informal sharing of questions and answers to get information from the children itself their thoughts and need in studying science and using computer to study.
- **Discussion**: While doing the science game as one parts of the system, my courses mate whom doing for the Mathematic games module and I always discuss the idea and techniques that we gathered to have a better output.

### 4.1.2 System Requirements Analysis

#### a) Non-Functional Requirements

A non-functional requirements or constraints describe a restriction on the system that limits one choice for constructing a solution to the problem (Pfleeger, 1998). Non-functional requirements for this project are described as below:

- **User-Friendly:** The layout of the system must be standardized when compared to others system, for example the placing of 'main menu' button

and 'quit' button in the certain place on every screen. The design of the icon also familiar to the users, which they can recognize what is the symbol that represent the function for each of the icon. The usage of suitable and meaningful options and icons will help the user to use the system with more confidence, easy to navigate, comfortable and save time. Users are allowed to browse and use the CD-ROM without any problem encounter.

- **Usability**: The application system must be easy to use. They can enhance and support rather than limit or restrict business process. Users are able to understand the most basic comments and navigation option to choose the modules that they interested. Users will be having no problem in remembering how to use and navigate in the system after a period of time of non-use. Besides, users can easily identified what they had gained after navigated the CD-ROM.
- **Attractive and interactive interface:** The interface design for this science games will be colorful and cartoonist due to the main users are kids from age 9 to 12 years old. Besides, sound will be added in the system that enhances the learning environment. Some animated characters would also be added in the interface. With attractive interface and an interactive multimedia, users are more comfortable and can have fun while visiting this CD-ROM.
- **Reliability:** The reliability is to convince the user that this system will make the correct respond and provide error-handling ability.

**b) Functional Requirement**

A functional requirement in describes an interaction between the system and its environment. Further, functional requirements describe how the system should behave given the certain stimuli (Pfleeger, 1998). In other words, it explains what the system

will do. Our Interactive Multimedia Educational Game system, which call "KidsHeaven" are divided into two main subject, which is "FunMaths" and "FunScience" and below are the explanation of functional requirements for "FunScience" module:

i. There are three levels, **Level 1, Level 2 and Level 3** for user to choose to start their game. The topics are included Animals, Weather, Earth Science Elements and Health.

ii. Each level is provided with 10 questions or more. Each of the correct answer will be given 10 points or less regarding to the number of the questions. Total points will be 100 points.

iii. To test the knowledge of the users in each categories with the levels that the users could achieve.

iv. Three main button, 'Help' button, 'Main' button and 'Quit' button are provided to let the users navigate the games easily. 'Help' button is provided to guide the users in using the CD-ROM and also guideline how to play the Math's and Science games. 'Main' button let the users back to the main screen to choose again either science or mathematics games they want to play. While the 'Quit' button to let the users stop playing and quit the games.

v. One more function will add in the system that is the "content" button. The "content" button will be placed on the screen after user select either games module in Level 1, Level 2 or Level 3. The "content" button is works, as when users click on it, the system will back to the "FunScience" main page to let user select again the game level they want to play.

### 4.1.3 Constraints in the Design

Typical constraints in the design of an interactive multimedia application include:

- Media configuration and performance, e.g. developers might have multi platform development strategy aimed at producing a good multimedia application.
- For the publishing market, or a much tailored approach for a specific purpose – a teaching and learning tool.
- The availability of expertise about the subject
- The accessibility of related multimedia documentation
- The budget and the deadline

The look and feel, interface and functionality of existing interactive multimedia application should be evaluated. It often helps to make a chart reveal that puzzle that multimedia design and production represents. Production is always governed by the delivery requirements, hardware limitations, storage capacities, and the speed of the programs that present the information. All the existing products analyzed will demonstrate the trade-offs the developers had to deal with in order to buy the projects to the perceived market.

The processor speed, the hard disk storage and access, and memory limitations have all been juggled to create the best application for the investment.

## 4.2 Hardware and Software Requirements

### 4.2.1 Choosing the platform

The word 'platform' was traditionally associated with hardware: the computer platform. But a platform can also describe software as well as hardware, and it is increasingly used in this way. For an offline application this might mean the operating

system, such as Windows NT, while for an online project it is more likely to refer to the browser, such as Netscape Navigator or Internet Explorer. A useful definition might be that the platform is whatever you have to specify in order to run the application. Often the specification will be extended to say what kind of display is needed, or how big a hard disk, or how fast an Internet connection. [1]

### 4.2.2 Delivery Platform

For multimedia there are issues of screen resolutions and bit depth, sound parameters, the speed of the CD-ROM drive, the way that video is handled, the amount of RAM and size of the hard disk…at least. [1]

Here, we have to choose the platform best suited to deliver the multimedia vision. Researched have been done to find a lowest common denominator for the machinery users have:

i) type and speed of processor (and therefore performance) - Pentium 366 Mhz and above

ii) amount of memory (RAM) - 64 MB RAM and above

iii) size of hard disk - 2 GB and above with 500MB of free disk space

iv) operating system - Windows 98 and above

v) resolution of the screen – 640 x 480 pixels and above

vi) number of colors on the screen – 256 and above

vii) sound handling (8 bit and above)

### 4.2.3 Delivery Medium

The delivery medium defined by which you get your application to the user. Here, the delivery medium that chosen are CD-ROM. This medium has become so universal that it seems unlikely that it may ever lose its supremacy as a carrier. [1]

### 4.2.4 Development Platform

We will also be making choices about the platform or platforms we use to design and build our system and to test it. It is more likely that we will use one consistent platform for our asset creation and manipulation for every application.

In the analysis of the entire platform, the Microsoft product is used as the main system platform.

- Windows 98 SE is used because it makes the programs run faster, optimize the performance of hard disk, and it is more reliable then last Window's edition.

### 4.3.4 Development Tools

Below are the design tools that will be used for develop the system:

#### 4.3.4.1 Authoring tools

***Macromedia Flash 5***

Macromedia Flash 5 is the professional standard for producing high-impact Web experiences. Macromedia Flash 5 allows user to fuse vector graphics with bitmaps, audio, animation, and advanced interactivity to create unique and effective Web sites.

**Flash 5 features:**

i) **Enhanced Color Controls**

The Color Panels within Flash 5 are an improvement as Flash now lists the hexadecimal codes for colors when users run their cursor over the color swatch. And it's easier to change colors by simply selecting an object and then selecting a different color with either the Color Selector or the Swatch Panel.

ii) **The Pen Tool**

Users are able to create more complex illustrations within the program by using Pen tool which included in Flash 5. The Pen tool allows user to define lines and shapes by placing a series of anchor points to create a path. The sub selection tool allows user to manipulate the lines and curves of the path by repositioning anchor points and adjusting their Bezier handles. User can also use the subselection and pen tools to modify shapes created with Flash's natural drawing tools.

iii) **Shared Libraries**

User can share library elements and save fonts to the library in this Flash version. Besides, user can link to library items in other Flash Player movies.

iv) **Custom Shortcut Keys**

The program now includes shortcut sets that mimic Fireworks, Freehand, Illustrator and Photoshop as well as the native Flash 5 set. User also can create their owns' custom set of keyboard shortcuts using the Keyboard Shortcuts dialog box.

v) **Support for Importing MP3 Sound Files**

User can import MP3 files in Flash 5. User don't have to compress the sounds during export a movie with sound, thus it can reduces the time required for publishing and exporting. Using compressed sounds also reduces the file size of completed movies and reduces memory requirements during authoring.

vi) **Expanded ActionScript**

ActionScript is a robust object-oriented programming language used to add interactivity to Flash movies. Users have a much finer level of control over the behavior of objects on the Stage with the new predefined classes. Besides, user have the ability to export and import ActionScript (.as) files, which makes sharing ActionScript between files a simple task. The development of Smart Clips, modular scripts that are parameterized into movie clips, which can be shared and reused between individuals, is an excellent time saving feature. XML objects and the Debugger are two useful advanced ActionScript functions.

vii) **The Movie Explorer**

The Movie Explorer enable user to navigate the Timeline of a movie, search for elements within a movie, perform site-wide editing, and print a list of movie contents. It's extremely handy to have the capability to display the complete contents of a movie. The Movie Explorer comes to the rescue by letting user search their Flash file for any symbol, font, or string of text.

***Macromedia Director 8.5 Shockwave Studio***

Macromedia Director 8.5 shockwave studio provides features that lets users to create the most media-rich, high-performance learning, entertainment, and merchandising applications for deployment to multiple environments, including the Internet, CD/DVD-ROM, and kiosks.

**Director 8.5 shockwave studio features:**

i) **Create streaming, interactive, multi-user content using:**

- Interactive 2D and real-time 3D animation
- Video: RealVideo, QuickTime, AVI
- Sounds: RealAudio, MP3, AIF, WAV
- Graphics: JPG, GIF, PNG, PSD, BMP, etc.
- Macromedia Flash
- Text and fonts

ii) **Deploy to fixed media.**

With the advances on the performance, media handling, and extensibility, Director 8.5 Shockwave Studio are ideally suited for deploying content on CD-ROM, DVD-ROM, kiosks, and other fixed media.

iii) **Get maximum performance with large files.**

With advanced memory management, Director 8.5 Shockwave Studio can quickly load and unload hundreds of megabytes of data into system memory. The result is consistent, smooth playback for end users.

i) **Take control with the extensibility of Director 8.5 Shockwave Studio.**

Users are able to launch other applications from within Director 8.5 Shockwave Studio. Besides, use also can input devices such as joysticks, and integrate custom functionality for the absolute best user experience.

v) **Use media-heavy content such as bitmaps, sound, and long video streams.** User can make media-rich content that's lightweight and high-performance Shockwave Studio with the advanced compression, extensive media support, and fast rendering engine of Director 8.5. Director 8.5 Shockwave Studio also supports many image formats such as GIF that

iii) user can use to create small, non-photo-realistic images and its programming language Lingo were designed to quickly animate many sprites (bitmaps, vectors, etc.) on the Stage for high-performing content.

***Macromedia Authorware 6.0***

Macromedia Authorware 6.0 provides a powerful environment for creating and presenting interactive information. Authorware basic features let user develop presentations quickly and easily, while advanced features offer greater authoring control.

Authorware 6 allows user to:

- Extend the expressiveness of e learning content with new authoring capabilities, including the ability to direct events over time.
- Publish projects for the Web or CD-ROM quickly and with one-button ease.
- Deliver powerful e-learning applications that leverage learning and Web standards

**Macromedia Authorware features:**

i) **One Button Publishing**

Users are able to integrates and automate all the steps in the publishing process by using one button publishing and making it possible to deliver applications for the Web, CD-ROM or corporate network with the click of a button.

ii) **MP3 Streaming Audio**

Audio-enable e-Learning applications designed for intranets and the Web by leverage low-bandwidth MP3 audio.

iii) **Media Synchronization**

User can direct events over time by synchronizing the display of text, graphics and other events with time-based media including audio and video files.

iv) **Rich Text Editor**

Users are able to create rich text files with a new editor that provides advanced formatting cap supporting extended properties and methods of ActiveX controls.

v) **Smaller Web Player**

User can downloads Authorware 6 content over the Web and it is 40% smaller compare to others web player.

vi) **SCORM Metadata Editor**

User can create a standards-compliant metadata file for user's courses to make e-Learning content easy to manage, reuse and deploy.

vii) **Rich Media Learning Aids**

With Authorware built right into the Help system with an interactive, multimedia tutorial, user can get started fast.

***Adobe Photoshop 6.0***

Adobe Photoshop 6.0 is the professional image-editing standard that helps user to express their creativity and work efficiently. With Photoshop 6.0, user can more easily produce exceptional imagery for print, the Web, wireless devices, and other media.

**Adobe Photoshop features**

i) **Actions**

Actions in Photoshop support the batch processing and task automation. Users are able to record a series of editing steps as an Action can be applied to any other selection in the different location such as in the same image, to another image file, or even to hundreds of files in a batch operation. In order to interactively adjust the filter setting, during the playback, users can play an action with selected steps disabled or display selected dialog boxes. In the Actions palette, various actions can be displayed at the same time, and sets of actions can be saved and loaded separately. Ability to batch-acquire images from a digital camera is one of the unique features of Actions. Actions will have a dramatic impact employed for image editing in Photoshop. This feature enables the print production shops to handle the process of hundreds of files, which are unattended.

ii) **Adjustment Layers**

The user can apply this feature without permanently modifying the original image special layers. An adjustment layer is a mask through which an image adjustment is applied. Numbers of adjustment layers can be loaded in the Layers palette, each adjustment layer modifying the layers that lie below. Similar to an image layer, an adjustment layer does not make permanent changes to the original image pixels. Although after the adjustment layer being modified for several times but the image quality will still remain the same. The same opacity and blending mode controls are also offered for image layers. Via any painting tools on the adjustment

layer, color and tonal adjustments can be simply interactively "painted" onto the image.

iii) **Free Transform**

User allows for numerous transformations with unparalleled control and image fidelity. Besides, it also enable the users in a single step, to scale, rotate, skew, add viewpoint to, or else distort a selected image area. Because of the image that does not need to be recalculated multiple times it helps in greater image fidelity and at the same time, it makes complex manipulations of images easier.

iv) **Navigator**

The Navigator offers rapid and precise access to magnified view of an image and a more efficient method for adjusting views of large images. By clicking the preferred view section within a resizable thumbnail of the image, user can progress rapidly to any position in a magnified image.

v) **Guides and Grids**

Photoshop provides standard features of page-layout and illustration programs to image editing. Guides provide accurate either horizontal or vertical lines to which tool operations can be snapped and the Guides settings are also recordable actions, making it straightforward in defining a particular guide setup to be shared with other users or applied to a number of documents. Similarly, the Grids attribute creates a regular pattern of snap points across the whole image.

vi) **Digital Watermarking**

Digital Watermarking introduces a capable technique for artistic professionals to shield the copyright of their images. The watermark is still

readable even after an image has been modified, or printed and re-scanned. Users can obtain copyright and artist information for registered images after Photoshop has read the watermark by linking the program to Digimarc Web site. Adding a watermark to images can also be done automatically by the Actions feature.

vii) **Multicolor Gradients**

The Photoshop did provide the supports for linear and radial gradients with varying levels of opacity and a wide variety of colors. Whenever a custom gradient is applied, the actual colors can be defined for the gradient designs, or the present background and foreground colors can be inserted automatically. Other than that it also allow the users to save their own custom gradient styles and allocate them for sharing with other users on either Windows or Macintosh platforms.

viii) **History Palette**

There is a History palette liberates in Adobe Photoshop that letting user undo and redo multiple editing steps instantly. The History palette tracks and displays a complete list of recent editing steps. User can review and move among these different stages by clicking anywhere in the list. User can save snapshots of an image to quickly compare different stages, and can paint the contents of a previous editing stage onto the current image with the History brush.

ix) **Integrated Adobe User Interface**

Photoshop integrates tightly with Adobe's full line of professional publishing and dynamic media tools. Photoshop shares a common user interface -- and in some cases, even core technologies - with Adobe

Illustrator, Adobe InDesign, Adobe Premiere, Adobe After Effects, and other Adobe products. User can work more efficiently and produce better results using this smooth integration across applications.

***Adobe Illustrator 10***

Adobe Illustrator provides a superior toolset for creating sophisticated artwork, technical illustrations, information graphics, and page designs for print, multimedia. Adobe Illustrator sets the industry standard for computer-based illustration and design.

**Adobe Illustrator advantages:**

**Integration with the Adobe Product Family**

Users use Adobe Illustrator with Photoshop and PageMaker to create a wide variety of printed and on-line materials. Adobe has focused on giving users a more integrated work environment that enhances their productivity and their user experience.

Adobe Illustrator offers the streamlined user interface, tabbed palettes, and familiar keyboard shortcuts that Photoshop and PageMaker provide.

**Cross-Platform Compatibility**

With Cross-Platform Compatibility, Graphic producers and designers can work together without regard for the hardware they use and invest precious time in developing Adobe Illustrator files on different systems.

**Exceptional Compatibility and Extensibility**

Adobe Illustrator enables users to opens files created in any prior version of the program on any platform. Full support for all Photoshop raster image formats

Graphics import:

i) Illustrator native format; EPS; PDF; CMX; CGM; WMF;

ii) Photoshop versions 2.5, 3.0, and 4.0; IFF; BMP;

Graphics export:

i) Illustrator native format; EPS; PDF; WMF;

ii) Photoshop version 4.0; IFF; BMP; GIF89a; JPG; PCX; PNG; PXR; TGA;

TIFF; and PICT.

Text import/export:

i) ASCII, RTF,

ii) Microsoft Word for the Macintosh, Microsoft Word for Windows

**Adobe Illustrator Features:**

i) **Gradients Palette**

Users can quickly create smooth graduated blends between two or more colors or tints with the new Gradients palette. Users can specify whether the gradient is linear or radial, and they set the angle of the blend.

ii) **Text Enhancements**

User can use the Character and Paragraph palettes to precisely control point size, leading, kerning, tracking, baseline shift, horizontal scale, hyphenation, paragraph indentation, letter and word spacing, and other text attributes. In addition, users can automatically check spelling, search and replace text by matching words or fonts, and apply smart punctuation, such as ligatures, em dashes, quotation marks, and so on.

iii) **Layers Palette**

The Layers palette lets users create, delete, modify, show, hide, lock, and move layers, as well as choose options that affect how layers print. Layers help users to manage elements in illustrations and isolate parts of a complex drawing to make edits more quickly.

iv) **Pathfinder Filters**

Pathfinder filters lets user to create objects instantly that would otherwise be challenging to create. Ten pathfinder filters create new objects by combining, subdividing, or isolating parts of overlapping objects.

v) **Multiple Levels of Undo and Redo**

Adobe Illustrator allows users to undo and redo up to 200 steps (the exact number of undo steps depends on the amount of RAM available). Users can change their minds or correct mistakes instantly.

vi) **Adobe Illustrator Artwork Conversion to Bitmaps**

Users can instantly convert any artwork they've created in Adobe Illustrator into raster images (also called bitmaps) at any resolution using any color space. They can then apply Photoshop-compatible filters to these raster images to instantly create effects that would be time-consuming or impossible to create by hand.

vii) **Photoshop Filters**

Users can apply any Adobe Photoshop plug-in filter or Adobe Photoshop-compatible filter to imported raster images or to rasterized artwork created in Adobe Illustrator. With these filters, users can distort images; create impressionistic, mosaic, blurred, and other effects; and produce a range of dazzling effects.

viii) **Built-In Color Separations**

Adobe Illustrator includes a number of supporting features—such as the ability to trap objects, apply halftone screen rulings, and convert all colors to CMYK colors—that help ensure the highest-quality printed results.

ix) **Align Palette**

The Align palette allows users to align selected objects along a vertical or horizontal axis using the bounding boxes of those objects.

x) **Transform Palette**

The Transform palette shows information about selected objects, such as the width and height of the object or its location in relation to the x and y axis. Users can then enter values to precisely change the dimensions of the object or move it to a new location. The Transform palette also allows users to skew or rotate objects.

xi) **Tools Palette**

Tools palette combines standard tools, such as the selection, pen, and oval tools, and special plug-in tools, such as the Star, Spiral, and Polygon tools, into one accessible palette lets users create a standard graphics.

xii) **Drag and Drop Between Adobe Programs**

Adobe Illustrator for Windows supports drag-and-drop functionality, so users can drag artwork from Adobe Illustrator and drop it in any other program that supports this feature.

### 4.3.4.2 Scripting Language

***Director's Lingo Scripts***

Lingo was the scripting language by Director. Using Lingo can assist the user to include interactivity to a movie and to control a movie in response to a particular conditions and events. Director uses four types of scripts which are behaviors, movie scripts, parent scripts, and scripts attached to cast members. Behaviors, movie scripts, and parent scripts all appear as cast members in the Cast window.

i) **Behavior**

A behavior is prewritten Lingo script that can be use to provide interactivity and include interesting effects to the movie. Most behaviors respond to simple events such as a click on a sprite or the entry of the playback head into a frame. When the event arises, the behavior performs an action, such as skip to a different frame or playing a sound. Although Director comes packaged with customizable, reusable behaviors for many basic functions but it also provide to the user the facility to create their own behaviors through writing Lingo script. Other than that, the behaviors can also be modified.

ii) **Movie scripts**

Movie scripts react to events such as key presses and mouse clicks, and can control what happens when a movie begins, stops, or pauses. Handlers in a movie script can be called from other scripts in the movie as the movie plays. Movie scripts are available to the whole movie, regardless of which frame the movie is in or which sprites the user is interacting with.

iii) **Parent scripts**

Parent scripts provide the advantages of object-oriented programming within Director. The advantages comprise the capability to write less code and use easier logic to carry out tasks in Lingo. It can also generate script objects that behave and react similarly but function independently of each other.

Lingo can create unlimited multiple copies (or instances) of a parent script and it is called a child object.

iv) **Scripts attached to cast members**

Scripts attached to cast members are attached directly to a cast member, independent of the Score. Whenever the cast member is assigned to a sprite, the cast member's script is available. Unlike behaviors, movie scripts, and parent scripts, cast member scripts don't appear in the Cast window. However, if Show Cast Member Script Icons is selected in the Cast Window Preferences dialog box, cast members that have a script attached display a small script icon in the lower left corner of their thumbnails in the Cast window.

***Flash's ActionScript***

ActionScript is Flash's scripting language that can use to control objects in Flash movies to create navigation and interactive elements and to extend Flash to create highly interactive movies and Web applications. Flash 5 ActionScript has many new features and syntax conventions that make it similar to the core JavaScript programming language.

**Differences between ActionScript and JavaScript**

If the user knows JavaScript, ActionScript will appear familiar to user. Some of the differences between ActionScript and JavaScript are as follows:

- ActionScript does not support browser-specific objects such as Document, Window, and Anchor.
- ActionScript does not completely support all of the JavaScript predefined objects.
- ActionScript supports syntax constructs that are not permitted in JavaScript (for example, the `tellTarget` and `ifFrameLoaded` actions and slash syntax).

- ActionScript does not support some JavaScript syntax constructs, such as `switch`, `continue`, `try`, `catch`, `throw`, and `statement` labels.
- ActionScript does not support the JavaScript `Function` constructor.
- In ActionScript, the `eval` action can only perform variable references.
- In JavaScript, `toString` of `undefined` is `undefined`. In Flash 5, for Flash 4 compatibility, `toString` of `undefined` is `" "`.
- In JavaScript, evaluating `undefined` in a numeric context results in `NaN`. In Flash 5, for Flash 4 compatibility, evaluating `undefined` results in `0`.
- ActionScript does not support Unicode; it supports ISO-8859-1 and Shift-JIS character set.

**ActionScript features:**

i) **Text editing**

User can enter scripts directly into the Actions panel in Expert Mode and choose elements from a pop-up menu or a Toolbox list.

ii) **Dot syntax**

Dot syntax enable user to get and set the properties and methods of an object, including movie clip instances and variables.

iii) **Data types**

Flash 5 ActionScript supports the data types included string, number, boolean, object, and movie clip. Multiple data types allow user to use different types of information in ActionScript.

iv) **Local variables**

User can declare local variables that expire at the end of the action list or function call. This allows users to manage memory and reuse variable names.

v) **User-defined functions**

User can define functions with parameters that return values. This allows user reusing blocks of code in the their scripts.

vi) **Predefined objects**

User can use predefined objects to access and manipulate certain types of information. The following are a few of the predefined objects:

- The Math object features a full complement of built-in mathematical constants and functions, such as `E` (Euler's constant), `cos` (Cosine), and `atan` (Arctangent).
- The Date object allows user to get information about the date and time on whatever system is running the Flash Player.
- The Sound object allows user to add sounds to a movie and control sounds in a movie as it plays. For example, user can adjust volume (`setVolume`), or balance (setPan).
- The Mouse object allows user to hide the standard cursor so that they can use a custom The MovieClip object allows user to control movie clips without using a wrapper action such as `tellTarget`. User can call a method such as `play`, `loadMovie`, or `duplicateMovieClip` from an instance name by using dot syntax (for example, `myMovieClip.play()`).cursor.

vii) **Clip actions**

`onClipEvent` action can use to assign actions directly to movie clip instances on the Stage. The `onClipEvent` action has events such as `load`, `enterFrame`, `mouseMove`, and `data` that allow user to create new kinds of advanced interactivity.

viii) **New actions**

New actions such as `do..while` and `for` can use to create complex loops. Other new actions are implemented as methods of the MovieClip object; for example, `getBounds`, `attachMovie`, `hitTest`, `swapDepths`, and `globalToLocal`.

ix) **Smart Clips**

Smart Clips have internal scripts that user or another developer, can change without using the Actions panel. User can pass values to a Smart Clip through clip parameters that they can define in the Library.

x) **Debugger**

The Debugger allows user to view and change variable and property values in a movie playing in Test-movie mode, the stand-alone Flash Player, or a Web browser. This allows user to easily find problems in their ActionScript.

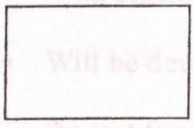
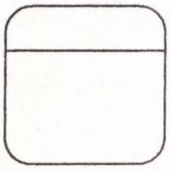
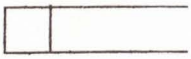
xi) **XML support**

The predefined XML object allows user to convert ActionScript to XML documents and pass them to server-side applications. User can also use the XML object to load XML documents into a Flash movie and interpret them. The predefined XMLSocket object allows user to create a continuous server connection to pass XML data for real-time applications.

# Chapter 5: System Design

Design is the creative process of transforming the problem into a solution or the description of a solution (Pelfre, 1998). Software design can be viewed in the same way. In this phase, the details of how the system will meet the requirements that identified during the requirements phase is described. Then the user requirements will be transformed into a working model, which is the guidance for developer before developing the complete system. [2]

For "FunScience", Data Flow Diagram and structured charts will be used to model the system. The structured charts are chosen to show the outline of the "FunScience" system. Data flow diagram will be use to provide the graphical illustration which shows the flow of data and logic within the system. Data flow diagram comprise of four basic symbols as shown below.

| Symbols | Name | Description |
|---|---|---|
|  | entity | An external entity that can send data to or receive data from the system. Interacts with the system but considered as outside of the boundaries of the system. |
|  | flow of data | It is used to show the movement of data from an origin to a destination with the head of arrow pointing towards the destination |
|  | process | It represents the transformation or processing of information within a system. |
|  | data store | It shows the repository for data that allows addition or retrieval of data |

## 5.1 Designing "FunScience" module

The system design of "FunScience" module is based on all the information gathered from the research that stated in Chapter 2, the Literature Review. The content of the system is designed based on the requirements of the end-users and the interface is designed according to end users interest other than taking the requirement of the attractiveness as consideration. Besides, to design a better system, the advantages and disadvantages of the existing systems in the market are taken into consideration.

Basically, these are the characteristic of "FunScience":

- User friendly
- Based on the Multimedia Interactive concept
- Instructions that are simple and easy to understand
- Games focused on 4 main topics included categories Animal, Weather, Earth Science Elements and Health.
- Well organized and easy to navigate
- Will be developed in English and in every screen there will be instructions in the text form and also simple animation.

**Structured of "KidsHeaven" Module**

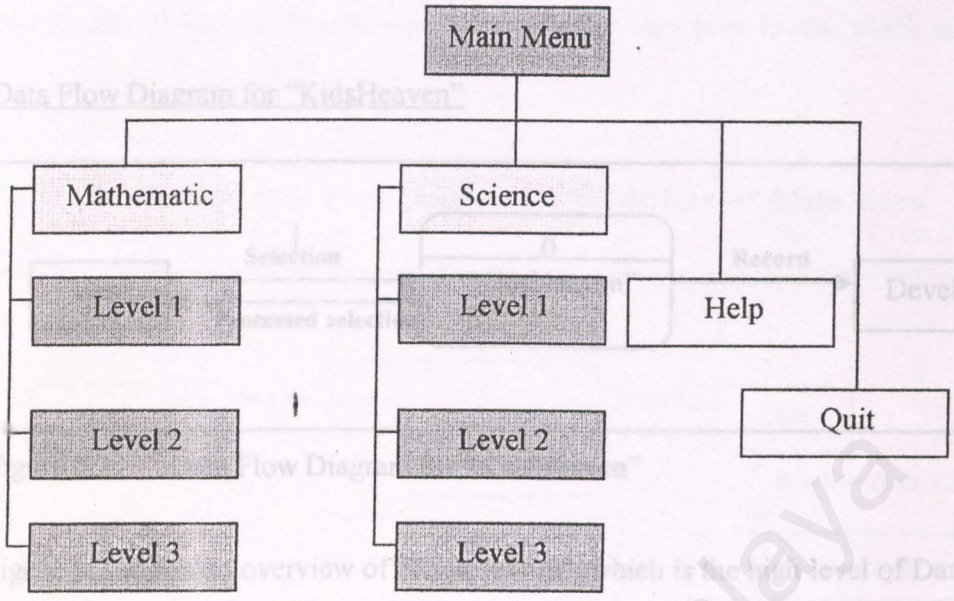



Figure 5.1: Structure design for "KidsHeaven" module.

Figure above is a concept map that illustrates the structure of the "KidsHeaven" module. The system will be divided to two main modules, which are "FunMaths" and "FunScience". The system will also include help and quit module. For "FunScience" module, it is broken up to three levels whereby each topic is divided into level 1, level 2, and level 3. For "FunMaths" module, I assume that my partner broken up it into three levels also. Each level will give the user different questions and to test their knowledge. The help function will guide the user on how to use the CD-ROM and guidelines how to play the Maths and Science games. While the quit button allow the user to quit the program anytime.

## 5.2 System Structural Design and DFD (Data Flow Diagram) for "KidsHeaven"

Data Flow Diagram for "KidsHeaven"

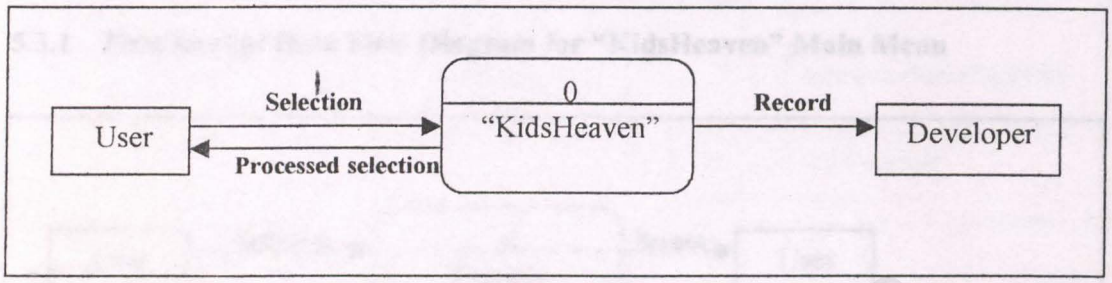



Figure 5.2: Data Flow Diagram for "KidsHeaven"

Figure 5.2 shows an overview of "KidsHeaven", which is the high level of Data Flow Diagram (DFD) diagram in"KidsHeaven". User can choose whether he or she want to view the content that are available on the screen, for example, Help module.

## 5.3 Fraction of "KidsHeaven" (Science Module)

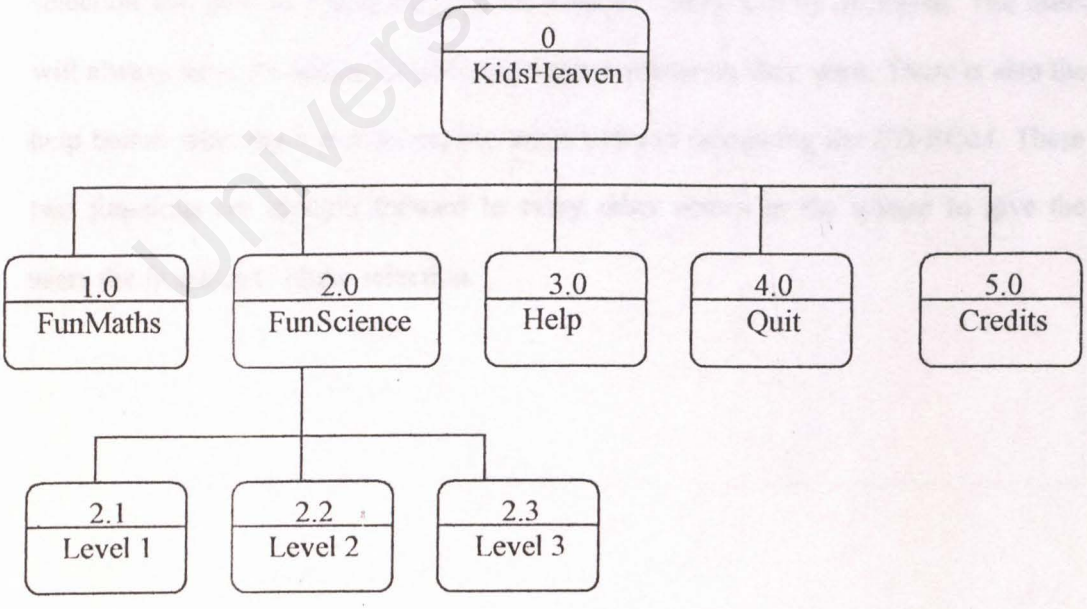



Figure 5.3: Fraction of "KidsHeaven" (Science Module)

Figure 5.3 shows the fraction of "KidsHeaven" for Science Module. "KidsHeaven" are divided into five main modules, which are "FunMaths", "FunScience", Quit, Help and Credits. While the "FunScience" itself divided into three levels, which are Level 1, Level 2 and Level 3.

### 5.3.1 First level of Data Flow Diagram for "KidsHeaven" Main Menu

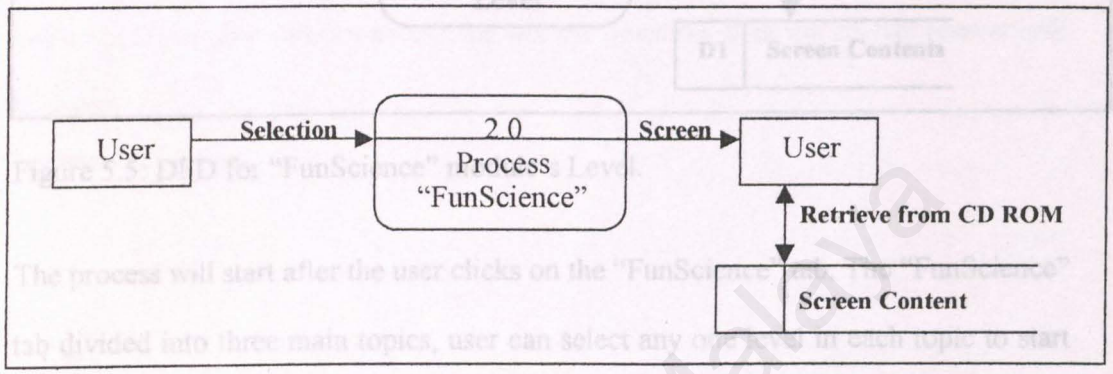



Figure 5.4: Data Flow Diagram for "KidsHeaven" Main Menu

From the main menu screen, the user can select any of the level of each topic to start to play the game. For instance, if the users select the "FunScience" module, this selection will then be processed, and the selected screen will be displayed. The users will always have the ability to quit the program whenever they want. There is also the help button whereby it can be used to assist users in navigating the CD-ROM. These two functions are brought forward to every other screen in the system to give the users the freedom to make selection.

### 5.3.2 Second level of DFD

Data Flow Diagram for "FunScience"

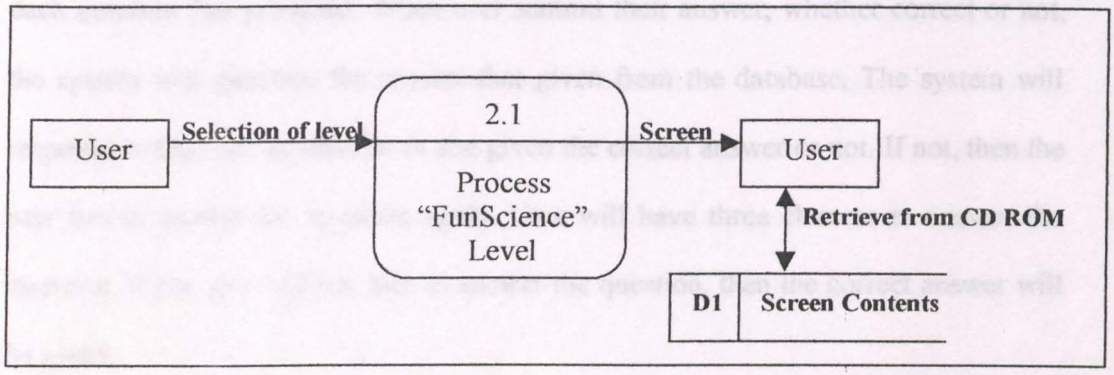



Figure 5.5: DFD for "FunScience" module's Level.

The process will start after the user clicks on the "FunScience" tab. The "FunScience" tab divided into three main topics, user can select any one level in each topic to start their game. For instance, when the user clicks on the Level 1 tab, the process will then begin to retrieve data from CD-ROM.

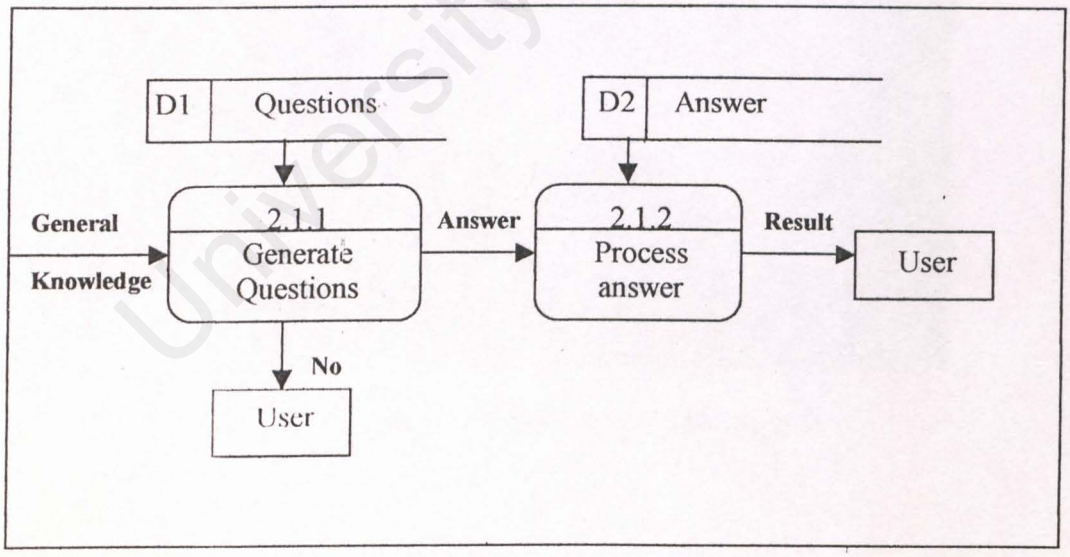



Figure 5.6: Child Diagram for process 2.1.

Figure 5.6 shows the child diagram for process 2.1. This is the process when users start to play their game. With the general knowledge the user has, user able to answer each question that provided. When user summit their answer, whether correct or not, the system will generate the answer that given from the database. The system will response to the user whether he or she given the correct answer or not. If not, then the user has to answer the question again. User will have three chances to answer the question. If the user still not able to answer the question, then the correct answer will be given.

## 5.4 System Interface

The system interface will give the first impression to the user about the system. It is the important part of the system. It will be easy for the user to navigate the whole system when the system interface is user-friendly and easy to understand. Few layouts are designed roughly before the actual system comes out and it is easy for further system implementation. The description of the few main pages also will be included as below.

### i. "KidsHeaven" Starting page

This is the first interface user will see after user insert the CD into the CD-ROM. User need to click on the "Click Here To Start" button or the cartoon logo to go to "KidsHeaven" Main page.


Figure 5.7: "KidsHeaven" Starting page

**ii. "KidsHeaven" Main page**

"KidsHeaven" Main page will appear when user click on the start button on the "KidsHeaven" starting page. The instruction below guide user to select either "FunMaths" or "FunScience" module they like to play. There are also Exit button provided in this screen.


Figure 5.8: "KidsHeaven" Main page

**iii. "FunScience" Main page**

After the user click on the "FunScience" button, the ""FunScience" main page will appear. There are three level that user can choose to start to play their games. Level 1 are encouraged for standard three and four, Level 2 for standard four and five while Level 3 are encouraged for standard five and six. There are also Help, Quit and Home button provided in this screen.

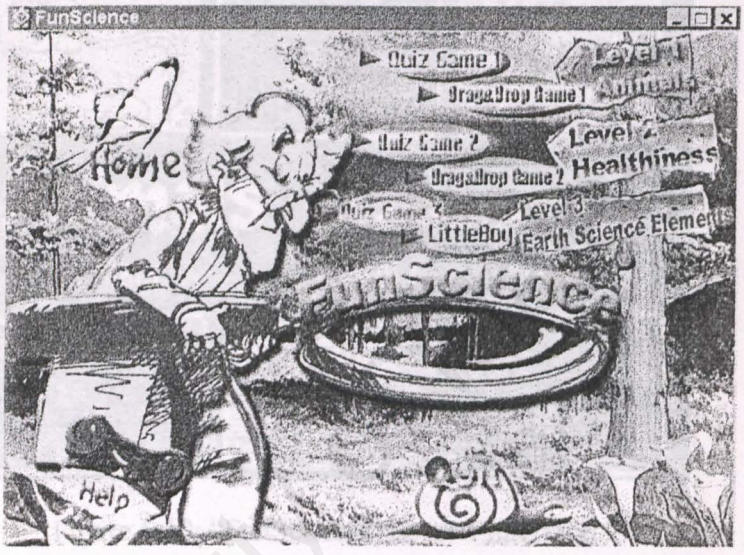



Figure 5.9: "FunScience" Main page

**iv. "KidsHeaven" Level 1 interface**

User start to play game in this interface. There are several functions that provided in this page included Help and Main button. The Main button where users click on it, the system will back to the "FunScience" main page to let user select again the game level they want to play. The score will be given after users choose the correct answer.

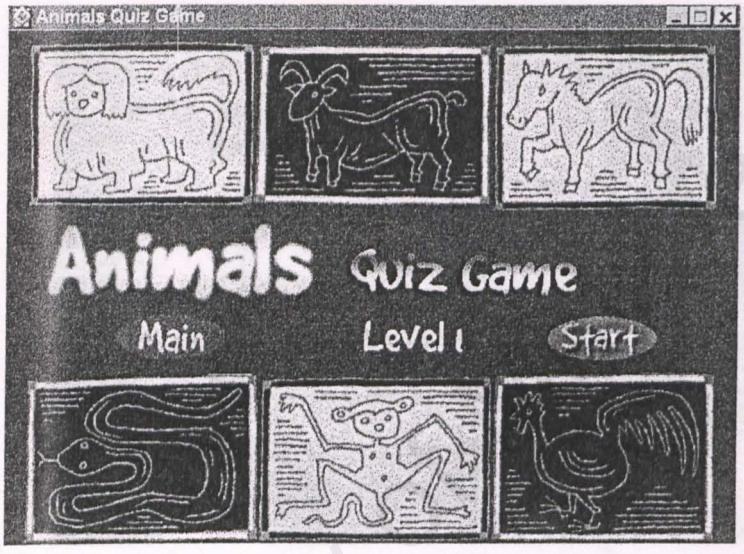



Figure 5.10: "FunScience" Level 1 interface

**v. "FunScience" Exit page**

While user click on the "Exit" button, they will bring to the screen as below. User will be asking ***"Are you sure you want to say GoodBye ???".*** If the click on "yes", then the program will exit immediately. If the user clicks "no", then it will back to the last screen where user existed.

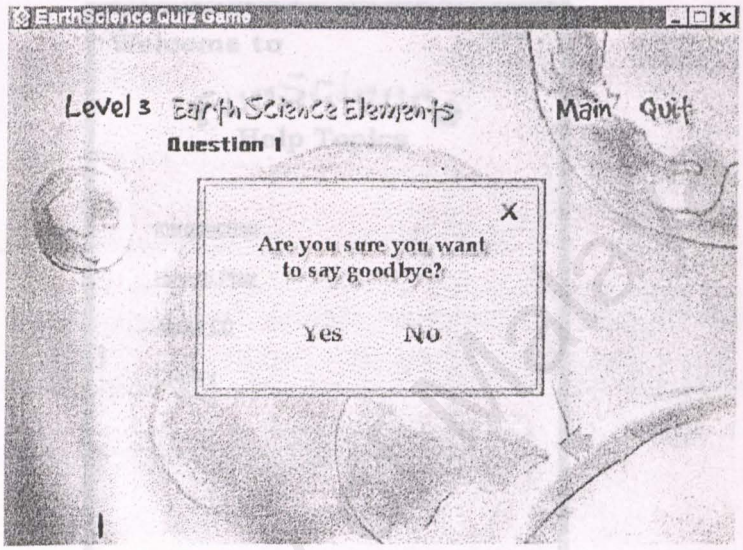



Figure 5.11: "FunScience" Exit page

**vi. "KidsHeaven" Help page**

When user click on the Help button, the screen as below will appear. Help functions will guide user while navigating this CD-ROM and guideline on how to play the games in the program. The help topics will include ***Introduction*** to "KidsHeaven", how to play the existing games in ***"FunScience"***, about the CD and Credits.

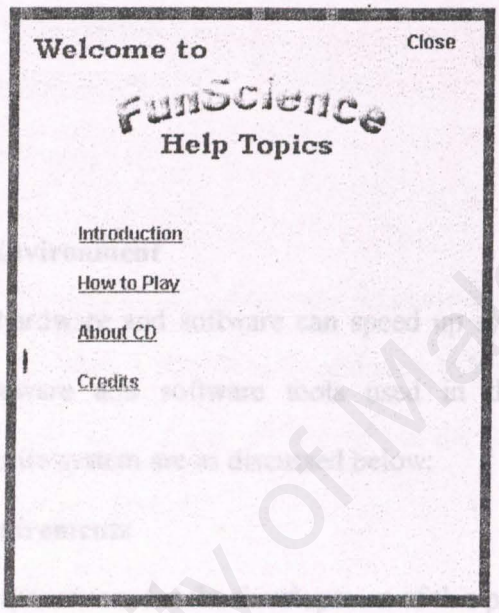



Figure 5.12: "FunScience" Help page

# Chapter 6 System Implementation

## 6.1 Introduction

System implementation is the process of "installing" the system:

- software (and hardware) installation
- necessary conversions
- user training
- auditing
- maintenance

## 6.2 Development Environment

Using suitable hardware and software can speed up system development or construction. The hardware and software tools used in the development and documentation of the entire system are as discussed below:

### 6.2.1 Hardware Requirements

The overall hardware requirements for the development of this project are

- Intel Pentium 3 667 Mhz processor running on Windows 98
- 192 MB RAM
- Color Monitor
- CD ROM Read and Write drive
- Display adapter
- 32 bits Sound card
- Speaker
- Keyboard
- Mouse
- Other standard desktop PC compliance

### 6.2.2 Software Tools Requirements

- Software tool for documentation and analysis
    - Microsoft Office 2000
    - Microsoft Access 2000
- Software tool for development
    - Macromedia Authorware 6
    - Macromedia Flash 5
    - Adobe Photoshop 7
    - Adobe Illustrator 10

## 6.3 Development of "Interactive Multimedia Educational Games"

Developer are required to create a user-friendly and easy to navigate interface at the early stage of the development. It is easy to carried out the requirement during the development with the assisted software.

### 6.3.1 Macromedia Authorware 6

Almost all of the parts in "KidsHeaven" are done using Authorware 6. Authorware 6 provides Knowledge Objects, which includes Application and Quiz for easy to build an application. Quiz Knowledge Object creates a quiz application, which includes the following question types: drag and drop, hot object, hot spot, multiple choice, short text, single choice, true/false

In "Interactive Multimedia Educational Games" project, Quiz Knowledge Object is used to build the quiz games for each level in "FunScience" games. While the drag and drop games and the Little Boy's game are created using the Function and Variables that are available in Authorware 6.

**Coding used in Macromedia Authorware 6**

***Initialize Quiz Properties***

```
--turn on CMI tracking
if pwLogonID > 0 then CMITrackAllInteractions := 1

--turn quiz marker on
quizActive := 1

--set number of questions to be presented
if _QuizSettings@"#1 - general prefs"[#NumberQuestionsToAsk] = 0 then
  _QuizSettings@"#1 - general prefs"[#NumberQuestionsToAsk] :=
IconNumChildren(pagingFrameworkID)
end if

--set number of questions missed to 0
quizNumErrors[sectionCurrent] := 0

--set questions presented to 0
quizQuestionsPresented[sectionCurrent] := 0

--set current section to 1, if quiz is running 'standalone'
if sectionCurrent = 0 then sectionCurrent := 1

--set current page number
quizCurrentPage := 1

--get page Map IconID's for navigation
if quizPagingIconIDs[sectionCurrent, 1] = "" | = 0 then
```

```
  quizPagingIconIDs[sectionCurrent] := []
  repeat with quizIndex[1] := 1 to IconNumChildren(pagingFrameworkID)
    quizPagingIconIDs[sectionCurrent, quizIndex[1]] :=
ChildNumToID(pagingFrameworkID, quizIndex[1])
  end repeat
end if

--set up question result storage
quizQuestionResults[sectionCurrent] := Array(0,
IconNumChildren(pagingFrameworkID), 3)

--quiz mastery score
quizMastery := _QuizSettings@"#1 - general prefs"[#PassingScore]
```

***Initial variables in Animals Drag&Drop games***

```
-- setup and test drag and drop interactions
obj1_targets := [0,0,0,0,1,0,0,0]
obj2_targets := [0,0,0,1,0,0,0,0]
obj3_targets := [0,1,0,0,0,0,0,0]
obj4_targets := [0,0,1,0,0,0,0,0]
obj5_targets := [1,0,0,0,0,0,0,0]
obj6_targets := [0,0,0,0,0,1,0,0]
obj7_targets := [0,0,0,0,0,0,1,0]
obj8_targets := [0,0,0,0,0,0,0,1]

main_list := [obj1_targets, obj2_targets, obj3_targets, obj4_targets,
obj5_targets, obj6_targets, obj7_targets, obj8_targets]
can_drop := [1,1,1,1,1,1,1,1] -- for "accept" target area active if
fields
```

```
obj_dropped := [0,0,0,0,0,0,0,0] -- for the iconids of the dropped
objects
obj_id := [0,0,0,0,0,0,0,0] -- for the iconids of the draggable
objects
good_hit := [0,0,0,0,0,0,0,0] -- answers
check_ans := FALSE -- trigger the one conditional
```

***Frequently used codes***

| **Functions** | **Tasks perforemed** |
|---|---|
| JumpFile("filename"[, "variable1, variable2, ...", ["folder"]]) | JumpFile causes Authorware to jump to the file developer specify in filename. |
| GoTo(IconID@"IconTitle") | When Authorware encounters a GoTo function, it jumps to the icon specify in IconTitle and continues its presentation from that icon. |
| Quit (option) | Quit immediately exits the file. What happens next depends on the option developer select. |

### 6.3.2 Adobe Photoshop 7

Some of the graphics and icons (Gif or Jpeg format) are downloaded from Internet and some of the graphics are created using Adobe Photoshop 7. The graphics and icons created using Photoshop are natural and suitable for the appearances of child playing games. Also, system comes out with a standard layout where user will easier to familiar with it.

### 6.3.3 Adobe Illustrator 10

Adobe Illustrator 10 is used to design and create a new graphics and imported into Adobe Photoshop for editing. Graphics can be created easily using Adobe Illustrator 10.

### 6.3.4 Macromedia Flash 5

Flash 5 used least during the development of "FunScience". The Flash file (.swf) are imported into the Drag & Drop game and will come out when user get 100 points or not performed well after finished the game play. It is easy to create an animation using Flash.

## 6.4 Graphical User Interface

Good screen design requires an understanding of many things. Included are the characteristics of people: how we see, understand, and think. It also includes how information must be visually presented to enhance human acceptance and comprehension, and how eye and hand movement must flow to minimize the potential for fatigue and injury. [3]

What the user interacts with is a collection of elements referred to as objects. Objects are always visible to the user and are used to perform task. [3]

There are several advantages of Graphical User Interface in "FunScience" interface design:

- **Symbols recognized faster than text:** Use button symbols, which found to be recognized faster and more accurately than text (Ells & Dewar, 1997). Color and shape are very useful for quickly classifying objects, elements, or text by some common property (Gittens, 1996).

- **Faster learning:** a graphical representation has been found to aid learning.
- **Easier Remembering:** because of greater simplicity, it is easier for casual users to retain operational concepts.
- **More attractive:** direct-manipulation systems are more entertaining and more appealing.
- **Low Typing Requirements:** pointing and selection controls such as the mouse eliminate the need for typing skills.

# Chapter 7 System Testing

## 7.1 System Testing

Testing means examining the project performance according to the specifications that have been agreed. This will include the robustness of the code or compatibility across different browsers, the structure and content of the program, the interface, the interactivity, the performance of the program, the look and feel. [1]

The objectives of testing are as below:

- ***Identify Errors*:** inspecting the functions of each part of the system is very important. This can help us to identify errors. Once errors are found, proper actions should be taken to overcome this problem.
- ***Removing Errors:*** This process involves fixing the problem found during the first phase above. The actual process of solving problems will vary with different problems.

## 7.2 Unit Testing

It is the test that performed on individual module in the subsystem. It was already performed in the coding phase. When a module was completed, it is tested to make sure the attached requirements are actually implemented by that module. All the links and buttons were tested to ensure that they bring users to the destination page.

Two areas are tested during Unit testing.

- **Module testing:** There are 8 sub modules in the "FunScience" module, which are Animals Quiz Game, Healthiness Quiz Game, Earth Science Elements Quiz Game, Drag and Drop Game 1, Drag and Drop Game 2, LittleBoy (guess a word game), Help menu and Quit. Each module is tested to avoid any problem encountered during deliverable phase.

- **Interface:** The interface is tested to make sure information flows properly into and out of the program unit. All of the buttons and the icons are ensured to well organized. For instance, we must make sure the entire interface, background and buttons in each module are standard and arrange in a proper way.

## 7.3 Integration Testing

Integration Testing is defined as an orderly progression of testing in which software elements, hardware elements, or both are combined and tested until the entire system has been integrated. The purpose of this testing is to ensure that design objectives are met. [U12]

In this stage, all the modules in "FunScience" are integrated and tested each other to make sure the module are link to correct place. The `JumpFile("filename"[, "variable1, variable2, ...", ["folder"]])` commands in Macromedia Authorware 6 is used to integrate all the games module. Integration testing also implemented in integration of "FunScience" and "FunMaths".

## 7.4 System Testing

System Testing is defined as the process of testing an integrated hardware and software system to verify that the system meets its specified requirements.

The purpose of this testing is to ensure that the software as a complete entity complies with its operational requirements. [U12]

## 7.5 Quality Assurance Testing

Quality Assurance Testing is to ensure, that before delivery of the CD to the user, the system is tested for stated specifications.

The Unit, Integration and System test specifications, prepared earlier, are executed. The purpose of this testing is to ensure that design objectives are met. [U12]

## 7.6 Acceptance Testing

Acceptance Testing is defined as the process of formal testing conducted to determine whether or not the system satisfies its acceptance criteria and to enable the user to determine whether or not accept the system.

The purpose of this testing is to ensure that Users' requirements objectives are met and that all the components are correctly included in a customer package. [U12]

## 7.7 Maintenance

After a software system has been verified, tested and implemented, it must continue to be maintained. Maintenance routines will vary depending on the type and complexity of the technology. System will need to be maintained to ensure that they continue to perform to the level demonstrated during the system testing stage.

Where modifications to software are made as a result of system maintenance or upgrades, it may be necessary to instigate further rounds of system verification and testing to ensure that standards are still met by the modified system. [U14]

There are several features in this "FunScience" that need to improved with maintenance:

- **Graphical User Interface:** User will find bored after playing the games for several time.
- **Content:** The content of the "FunScience" need to be updated with new version due to changes in the natural of the software. The questions provided in each game also need to be changed or added for next version so that user can update their knowledge with the CD.
- **Media sound or voice over:** The media elements should be added into the system to enhance interactivity and attractive environment to the user.

## 7.8 Conclusion

All the necessary details of implementation and testing strategies for this package have been included here for better understanding of the package. This package was developed according to the analysis done so that all the requirements are met and match to the users needs.

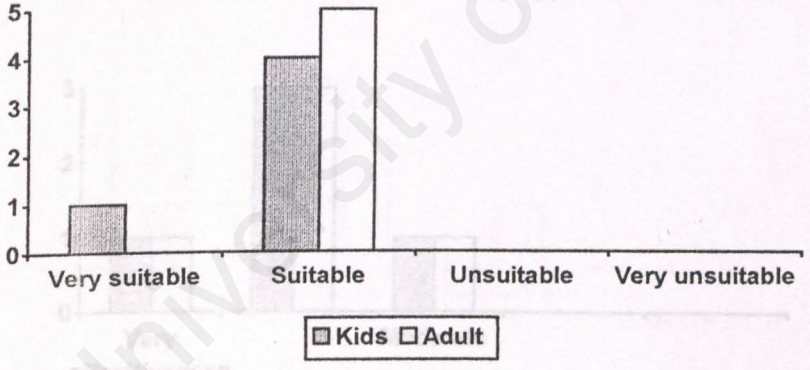
# Chapter 8 System Evaluation

## 8.1 User Evaluation

After the system was fully developed, user evaluation was conducted to assess the effectiveness, the general outlook of this "FunScience" module and to determine if this "FunScience" module meets the users' need and expectation. 5 samples were taken from the students from University Malaya and 5 samples were taken from primary school students in Kuala Lumpur area. The user evaluation's questionnaire can be obtained from appendix B at the end of this report.

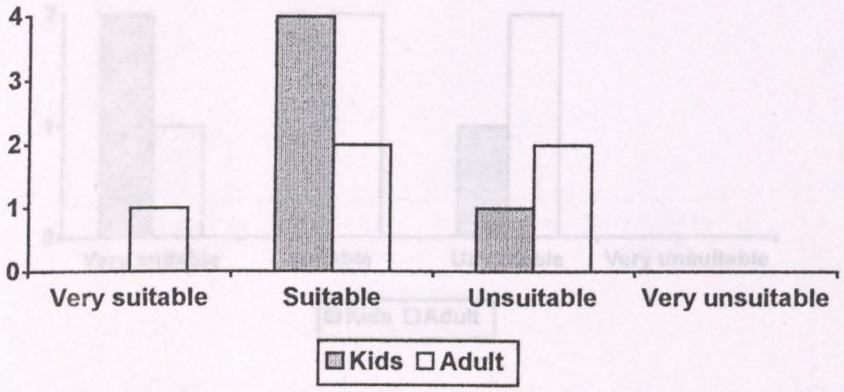
**Result:**

1. The scope of the questions used in the games.



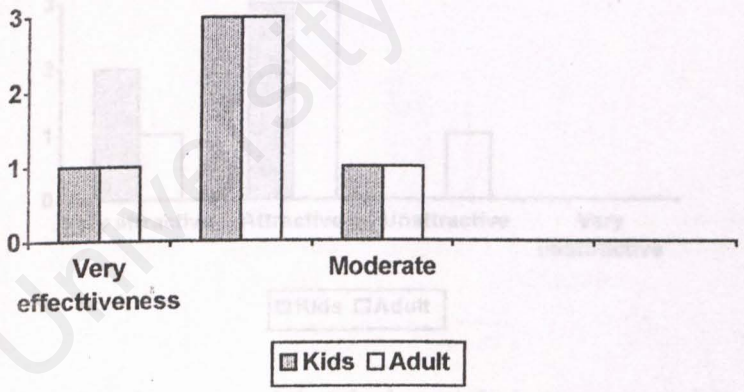

Most of the respondents, 4 kids and 5 adults agreed that the scopes of the questions used in the game are suitable. The scopes cover topics, which are animals, Healthiness and Earth Science Elements to test the user's general knowledge.

2. Level of difficulty is appropriate for the stated age/grade level.



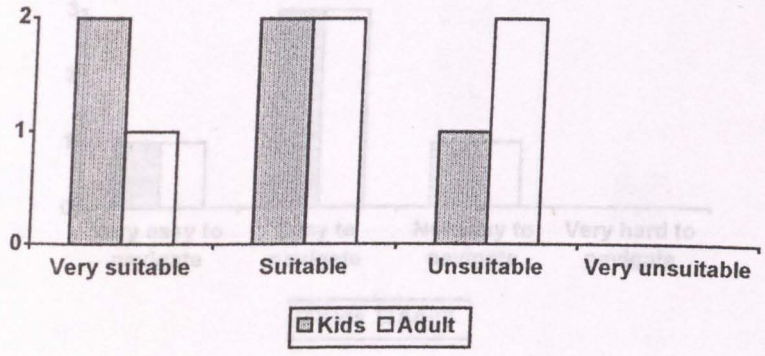

Some of the respondents think that the level of difficulty is unsuitable for the stated age because they may think the students who are not English educated will feel uneasy to play with the game.

3. The effectiveness on learning (knowledge gained) after used the system.



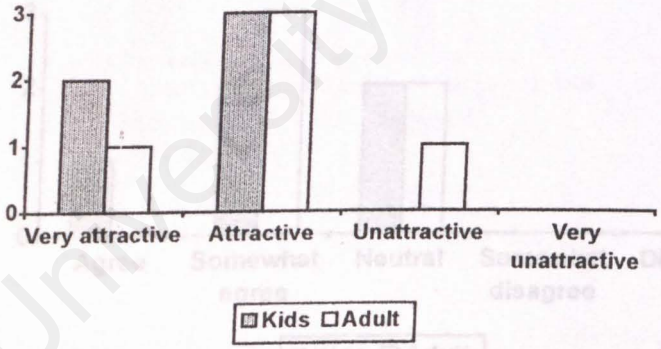

Most of the respondents found that the effectiveness on learning (knowledge gained) after play with the "FunScience" is effectiveness. They may gain a lot of knowledge out of textbook used in school.

4. The color combination of the user interface design.



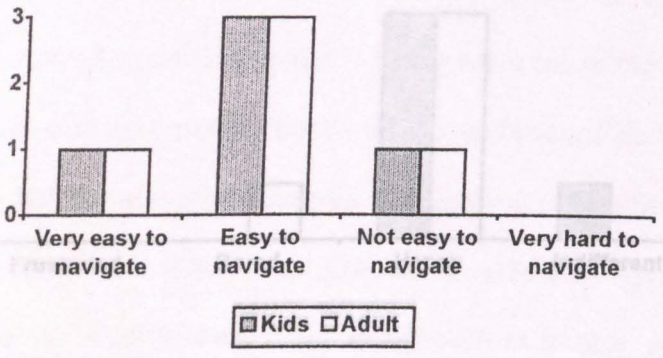

Some of the respondents think that the color combination of the interface design is not suitable because there are too much color used in "FunScience". But some of them agree that the color combinations are very suitable because it can attract user's concentration.

5. The Educational Games layout design.



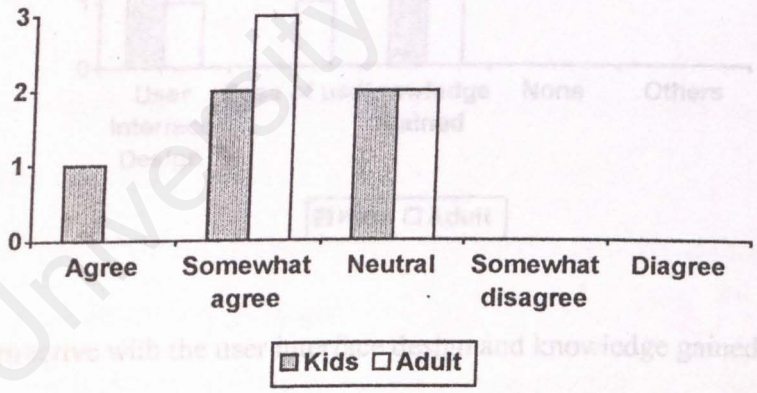

Generally, the respondents agreed that the layout designs are very nice and attractive. The buttons are easy to recognized and user feel easy to interact with the interface.

6. The interaction between each module in "FunScience".



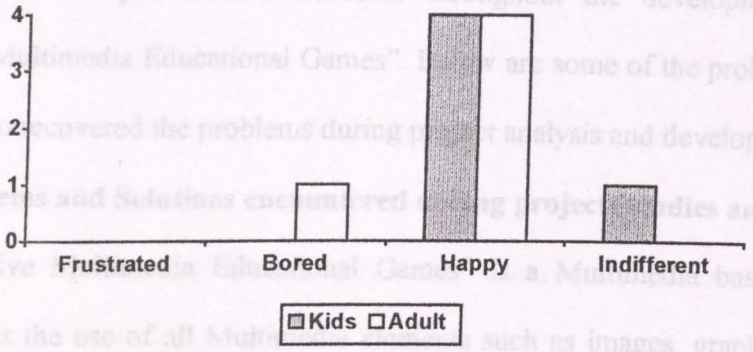

Most of the respondents agreed that "FunScience" are easy to navigate. While few of them found uneasy to navigate. According to the respondents, this is because they are unfamiliar with the CD-ROM based learning and first timer in the "FunScience".

7. User will be able to use program independently.



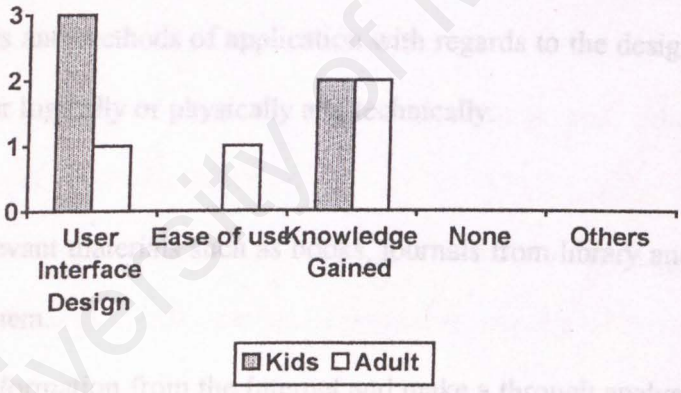

Most of the respondents may think that children who play the "FunScience" games need their parents to accompany them and explain what happening in "FunScience". So as the child who are not computer literate.

8. General attitude




It is clear that most of the respondents are happy playing with the "FunScience". Adult may felt bored because the children are main target for this system.

9. Things you liked:




"FunScience" is attractive with the user interface design and knowledge gained. Only one of the respondents likes the ease of use of the system.

## 8.2 Project Problems and Solutions

There were several problems encountered throughout the development of the "Interactive Multimedia Educational Games". Below are some of the problems found and the way to recovered the problems during project analysis and development.

### 8.2.1 Problems and Solutions encountered during projects studies and analysis

The "Interactive Multimedia Educational Games" is a Multimedia based project, which acquires the use of all Multimedia elements such as images, graphics, audio, animation and text integrated in it.

***Problems:***

1. The main problem during project studies and analysis is choosing the suitable platform and software for developing this project.
2. Choosing the appropriate development life circle model and methodology.
3. Finding facts and methods of application with regards to the design of the project either logically or physically and technically.

***Solutions:***

1. Refer on relevant materials such as books, journals from library and try to understand them.
2. Retrieving information from the Internet and make a through analysis with regards to the mentioned problems.
3. Refer to the previous projects that done by senior students in the Bilik Dokumen of FSKTM.
4. Supervision of supervisor and moderator and also course mate's advice and guidance.

### 8.2.2 Problems and Solutions encountered during projects implementation and testing.

***Problems:***

1. Learning to use Macromedia Authorware 6, Macromedia Flash 5 and also Abode Photoshop 7.
2. Choosing the appropriate images and icons for the interface that are suitable for children.
3. Designing the suitable and attractive layout for the interface.
4. Integrating few files into a project with Flash 5.
5. Testing the entire system at another computer and different platform.

***Solutions:***

1. Get Help menu accompany with the software from program files to understand how to use the particular software.
2. Refer to other projects done previously by senior and Educational Software that are available in market.
3. Viewing the tool tips and the Help menu found from the Internet.
4. Some of the features or links cannot be presented properly when testing is done on another computer. Therefore some changes need to rearrange a to make sure all the features presented well.

## 8.3 System Strengths

1. With attractive and interactive user interface, users will get easy to familiar with the system.
2. Links and navigation are easy to follow through the use of meaningful and recognizable icons and buttons.

3. English Language as a delivery language due to teaching of Science and Mathematics in English is confined to Year One, Form One and Lower Six this year.
4. Audio narration to increase understandability of the particular component and increase the study mood.
5. Users can exit the system and link to main screen at anytime.
6. Help file let users to refer how to play with all the game that are available in the "FunScience" module.
7. Question provided in the quiz games are filtered and summarized according to user's capability. Some of the questions may be a bit difficult to the users, the aimed is test the users general knowledge about Science elements. Users can check the answer by clicking the ANSWER button.

## 8.4 System Limitations

1. Most of the computer cannot support the fonts used in the system. User may need to copy the fonts from the CD to `C:\WINDOWS\Fonts`.
2. Buttons are static. No changes on button while user rollover or click on it.
3. Help file not available in Quiz game.
4. User cannot keep track on the points collected after each question being answered. They can only check the score at the end of the game.
5. Users are not able to keep track their score or game when the next enter to this system again. There is no database provided to store user information in the system.
6. The KidsHeaven.exe file is not able to convert to installer. Therefore user need to insert the CD every time they want to view this system.

7. No immediate feedback from system when user summit their answer in Drag and Drop game. User are not able to check which part are done wrong.

## 8.5 Future Enhancements

1. Use the fonts that can support by most of the computer during system development.
2. Make user able to track their score or games had been played when the next enter to this system again by provided a database to store user's pass record in the system.
3. Standardized the layout so that it looks more professionally.
4. Available the Help function in Quiz Game.
5. Make the button can be changed to different color when the mouse rollover or click on it.
6. Convert KidsHeaven.exe file to installer.
7. Add a function that system can give a feedback immediately when user summit their answer in Drag and Drop game.

## 8.6 Suggestions for course improvement

1. Have a library in FSKTM, which completed with computer's relevant books for students to refer.
2. Equip more the computer with CD writer.
3. Allow to view previous real time system that done by last senior student.

## 8.7 Conclusion

Finally, the "Interactive Multimedia Educational Games" has been reaching its end stage. Fortunately this system is completed on time and can be integrated successfully with Maths Module that had been done by my teammate. All the requirements, which have been defined in the scope of this project, have been achieved.

Most of the objectives are able to meet after the completion of the system. Such as user can analyze, evaluate and think about ideas and information logically and critically. This system also instills proper values and attitudes in the learning and practice of science and let the kids to be more computer literate. The CD-ROM based multimedia learning and teaching science also convenient for primary school due to the user interface designs are attractive and can increase learning environment.

My problems arose concerning with the software development is I am not actually very clear and understood about Authorawre at the beginning. This will affect the quality of the content. With misunderstanding of requirements, several researches had to be done. But to me it was not considered a bad aspect as a whole. In fact, it helped me learn to understand the content of the software and able to summaries the content according to the needs of the users.

Throughout this project, there are more enhancements on our project development skills, so as our project management skills. New knowledge had been acquired and having up to date knowledge and information becomes important in keeping abreast with the fast and ever changing fields in the information technology edge.

# Appendix A

# User Manual

## Table of Contents

## List of figures

# Introduction

The "Interactive Multimedia Educational Games" for "FunScience" subsystem consists of 6 modules:

## 1.1 Level 1

- Animals Quiz Game
- Drag and Drop Game 1

## 1.2 Level 2

- Healthiness Quiz Game
- Drag and Drop Game 2

## 1.3 Level 3

- Earth Science Elements Quiz Game
- LittleBoy (Guess a word game)

In addition, Help function is included in the system

# 2. Getting Started

2.1 First screen to see while load the "KidsHeaven" CD


Figure 1: KidsHeaven main interface

1. After insert the CD into the CD-ROM, the system will auto run the "KidsHeaven.exe" and this is the first screen user will see.

2.2 Prompt user to input their name.

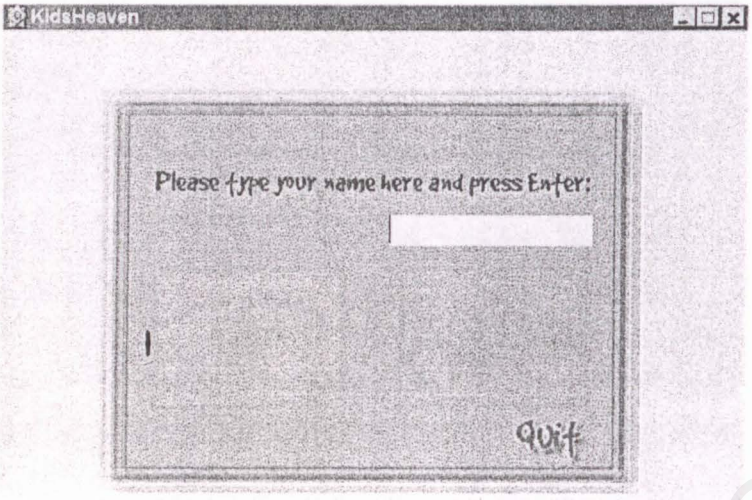



Figure 2: User's enter name interface

1. The system will then proceed to the next screen (Figure 2) and prompt user to enter his/ her name.
2. User can quit from the system in anytime.

2.3 Choose "FunMaths" or "FunScience" game to start.


Figure 3: "KidsHeaven" Home interface

3. This is the Home interface for "KidsHeaven". User can choose either "FunMaths" or "FunScience" to start playing the game.

2.4 Choose a game from "FunScience"

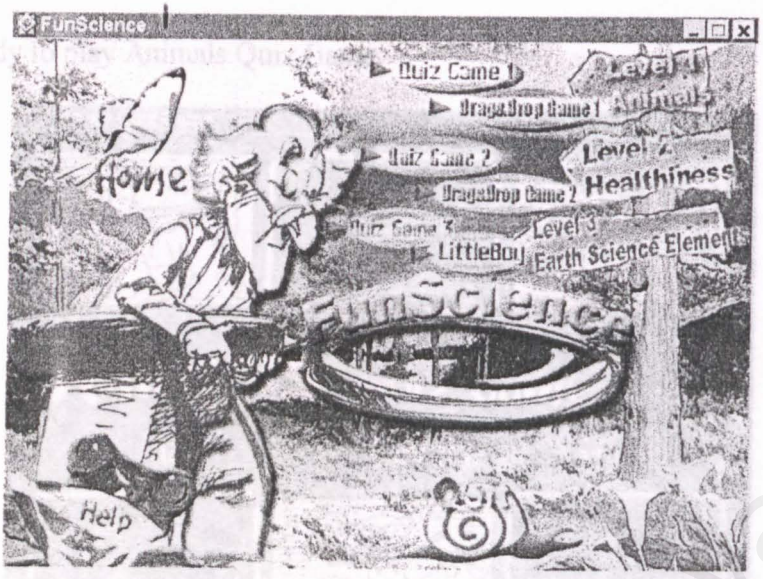



Figure 4: "FunScience" main interface

1. When user choose "FunScience" module, the "FunScience" main screen will come out.
2. There are 6 games which are Animals Quiz Game, Drag and Drop Game 1, Healthiness Quiz Game, Drag and Drop Game 2, Earth Science Elements Quiz Game and LittleBoy (guess a word game) that user can choose to start the game they want to play.
3. User can back to "KidsHeaven" Home interface by clicking the "Home" button.
4. User also can seek for Help by clicking the "Help" button.
5. "Quit" button to let user quit from system at anytime.

# 3. Playing a game

## 3.1 Ready to play Animals Quiz Game

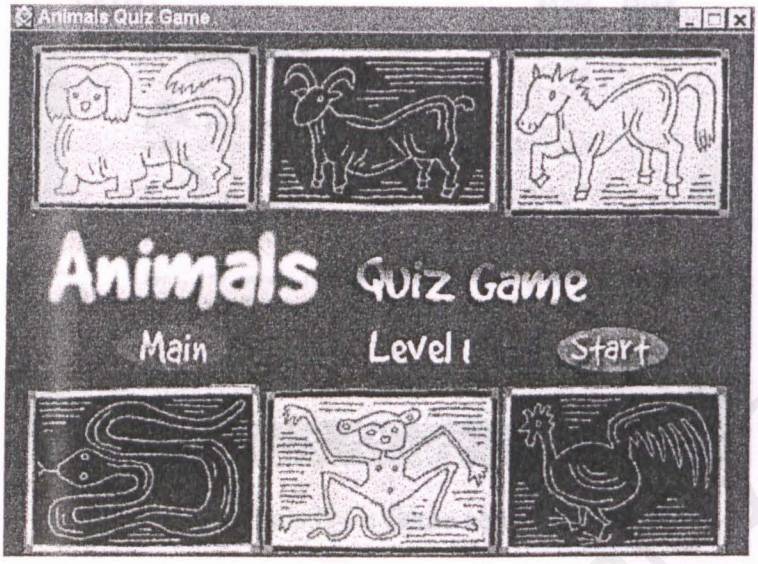



Figure 5: Animals Quiz Game interface

1. Users are in ready state to play the Animals Quiz Game in Level 1.
2. Click on the "Start" button to start to play the game.
3. Click on the "Main" button to go to "FunScience" main interface.

3.2 Playing the quiz game

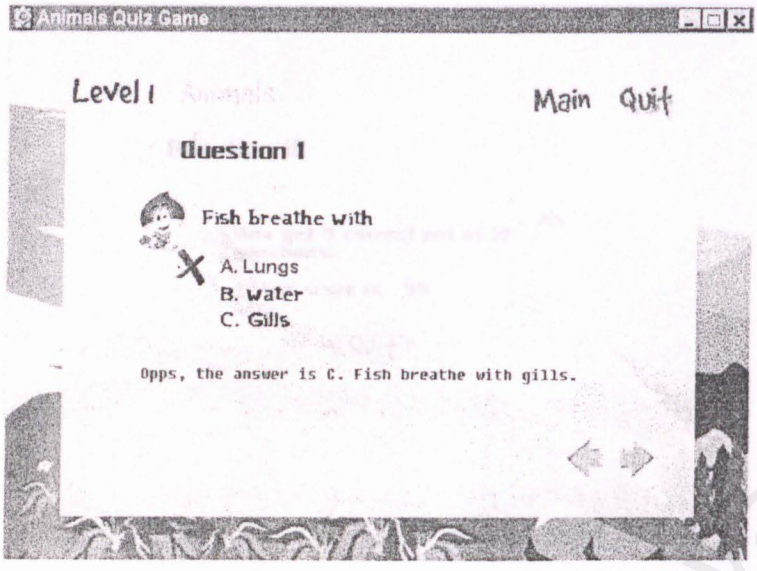



Figure 6: Animals Quiz Game content interface

1. User needs to answer the single choice quiz by click on the selected answer.
2. User can check their answer by clicking on the "ANSWER" button or press ENTER on the keyboard.
3. An explanation of the correct answer will be shown.
4. Click on the next button to proceed to next question.

3.3 Show the score

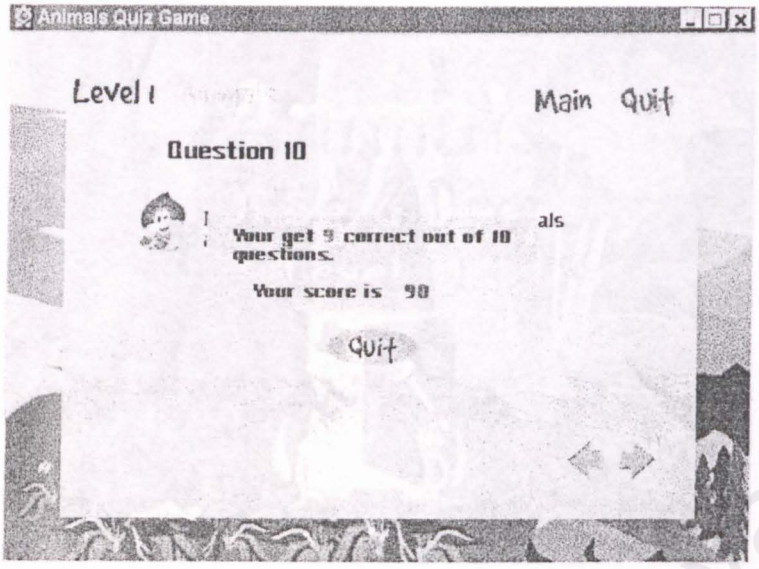



Figure 7: Quiz Game score interface

1. The score come out when user successfully answer the entire question provided.
2. Click on the "Quit" button to confirm to exit the system or click on the "Main" button to go to "FunScience" main interface.

3.4 Ready to play Drag and Drop Game 1

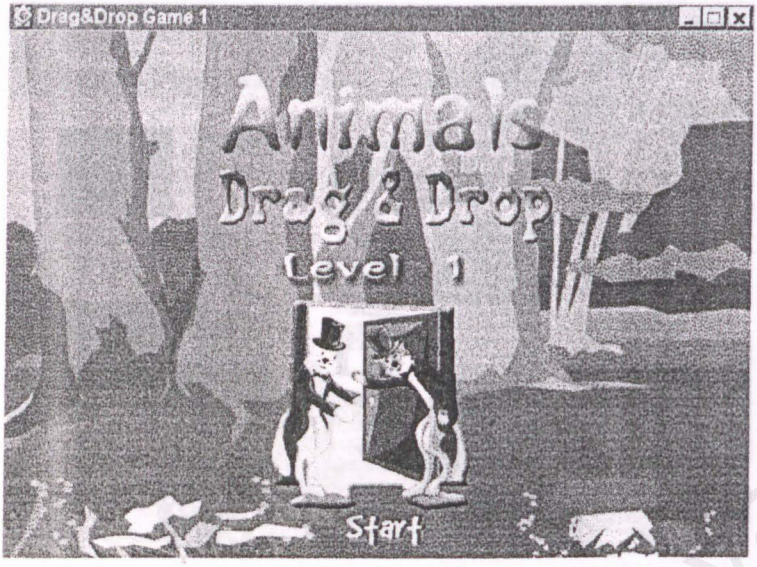



Figure 8: Animals Drag and Drop Game interface

1. User is in ready state to play the Drag and Drop Game in Level 1.
2. Click on the icon above the "Start" to start to play the game.

3.5 Playing the Animal's Drag and Drop Game

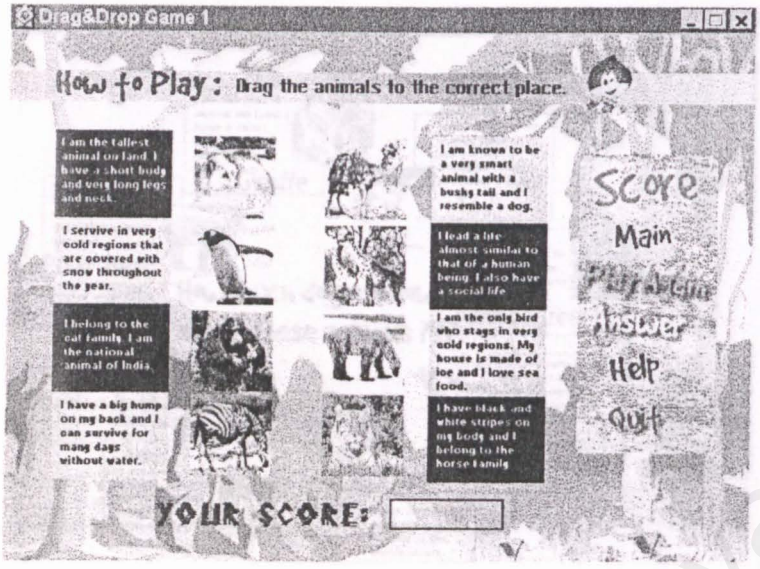



Figure 9: Animal's Drag and Drop Game content interface

1. The screen show that user can play the game by drag the animals to correct place.
2. Click on the "Score" button to check the score.
3. The "Main" button to go to "FunScience" main interface.
4. The "Play Again" button to restart the game.
5. The "Answer" button to show the answer given.
6. The "help" button to seek for help.
7. The "Quit" button to exit the system.

3.5 Answers for Animal's Drag and Drop Game

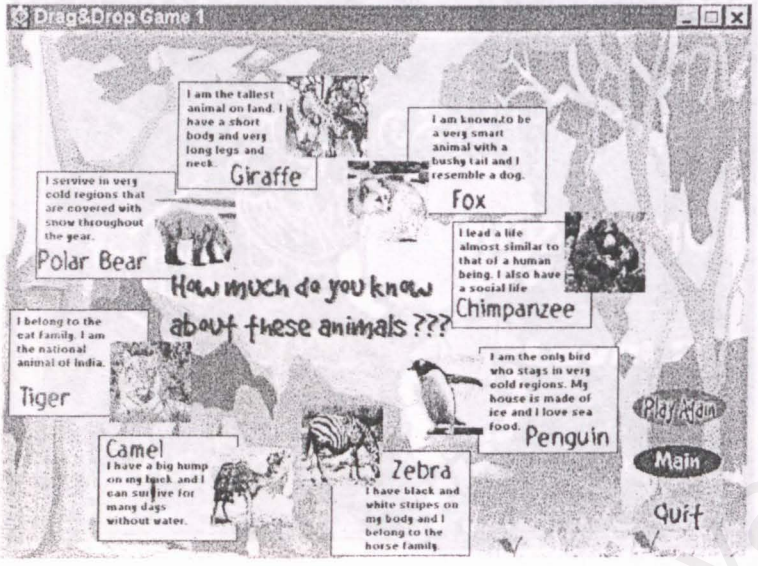



Figure 10: Animals Drag and Drop Game answer's interface

1. User can check their answer on this scene.
2. The "Play Again" button to restart the game.
3. The "Main" button to go to "FunScience" main interface.
4. The "Quit" button to exit the system.

3.6 Ready to play Healthiness Quiz Game

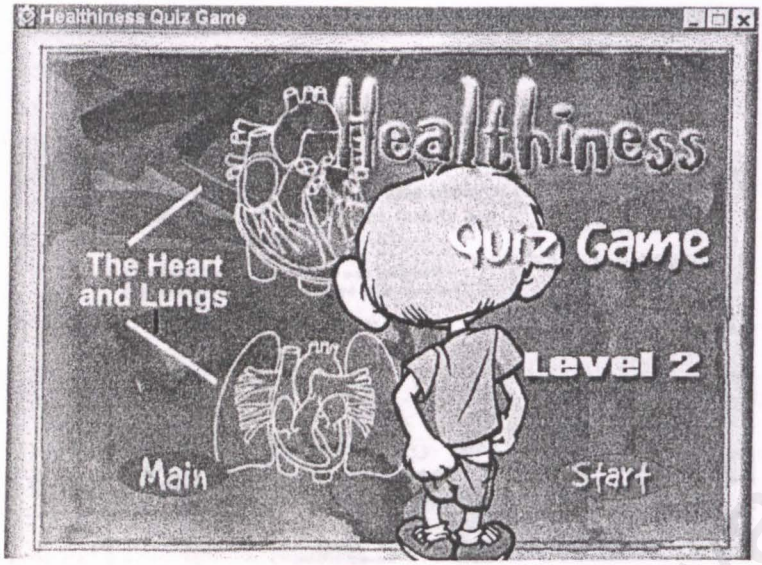



Figure 11: Healthiness Quiz Game interface

1. Users are in ready state to play the Healthiness Quiz Game in Level 2.
2. Click on the "Start" button to start to play the game.
3. Click on the "Main" button to go to "FunScience" main interface.

3.7 Playing the Healthiness Quiz Game

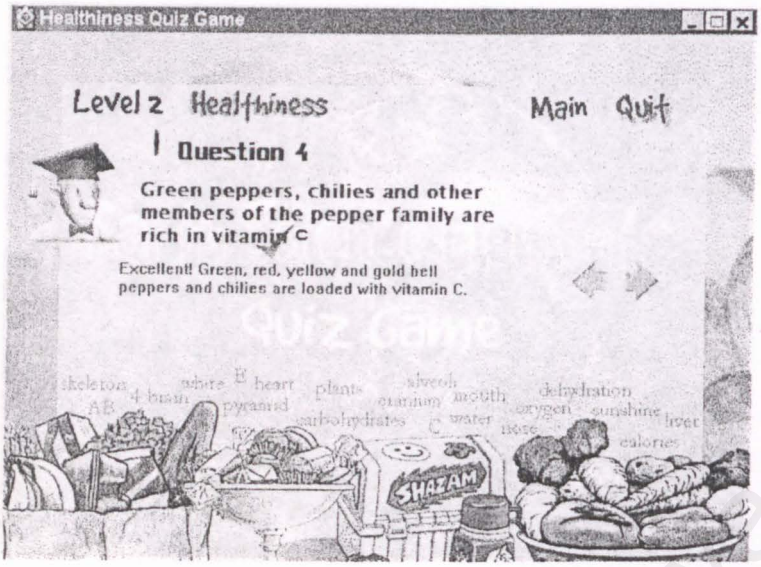



Figure 12: Healthiness Quiz Game content interface

1. User needs to fill in the blank by typing in the selected answer.
2. Clues are given on the screen.
3. User can check their answer by clicking on the "ANSWER" button or press ENTER on the keyboard
4. An explanation of the correct answer will be shown.
5. Click on the next button to proceed to next question.

3.8 Ready to play Earth Science Elements Quiz Game

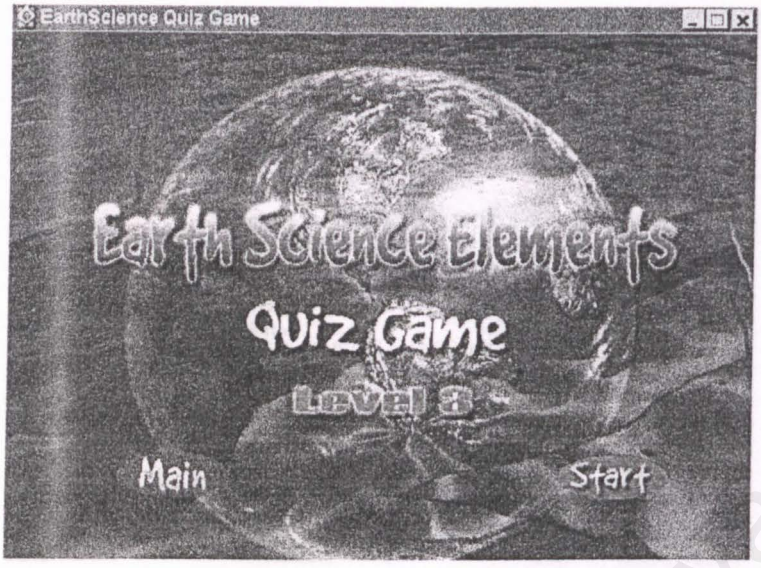



Figure 13: Earth Science Elements Quiz Game interface

1. Users are in ready state to play the Earth Science Quiz Game in Level 3.
2. Click on the "Start" button to start to play the game.
3. Click on the "Main" button to go to "FunScience" main interface.

3.9 Playing the Earth Science Elements Quiz Game

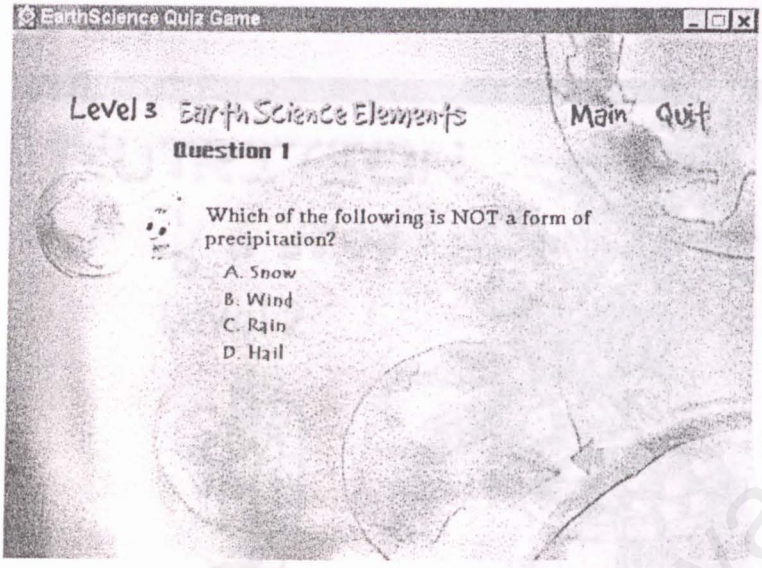



Figure 14: Earth Science Elements Quiz Game content interface

1. User needs to answer the single choice quiz by click on the selected answer or fill in the blank by typing in the selected answer.
2. User can check their answer by clicking on the "ANSWER" button or press ENTER on the keyboard.
3. An explanation of the correct answer will be shown.
4. Click on the next button to proceed to next question.

3.10 Ready to play Nutrition's Drag and Drop Game

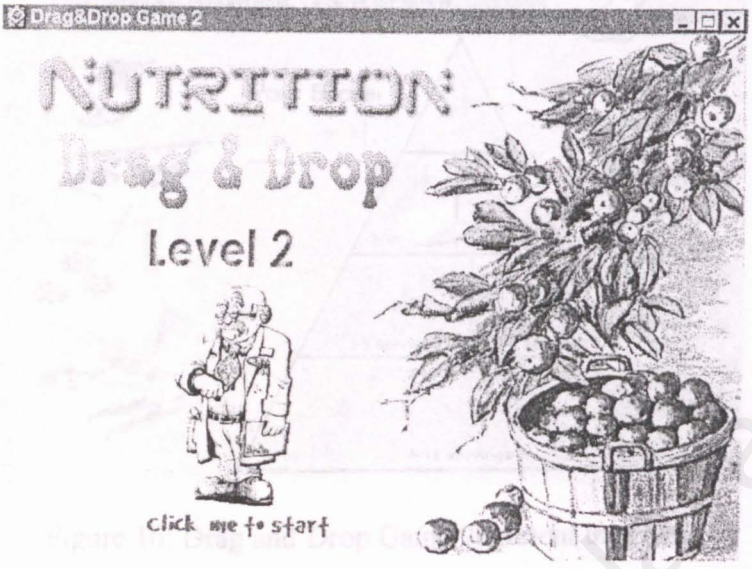



Figure 15: Drag and Drop Game 2 interface

1. User is in ready state to play the Drag and Drop Game in Level 2.
2. Click on the icon above the "Click me to start" to start to play the game.

## 3.11 Playing the Nutrition's Drag and Drop Game

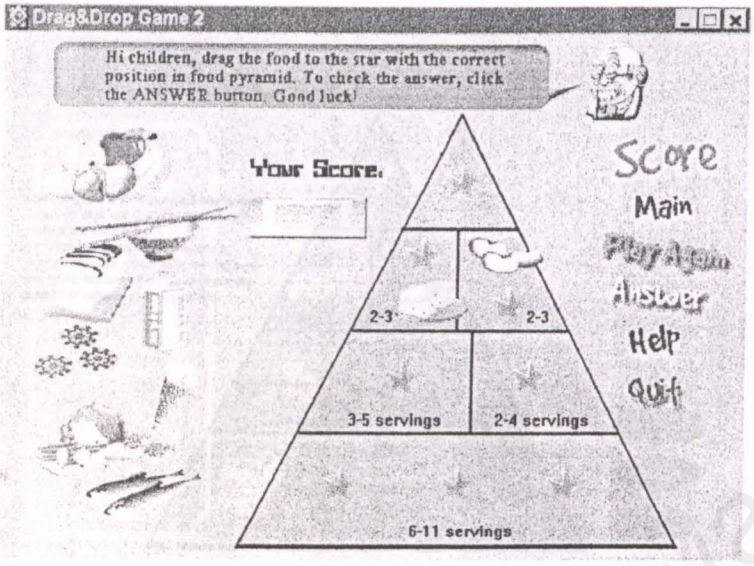



Figure 16: Drag and Drop Game 2 content interface

1. User can drag the food to the start with the correct position in food pyramid.
2. Click on the "Score" button to check the score.
3. The "Main" button to go to "FunScience" main interface
4. The "Play Again" button to restart the game.
5. The "Answer" button to show the answer given.
6. The "help" button to seek for help.
7. The "Quit" button to exit the system.

## 3.12 Answer for Nutrition's Drag and Drop Game

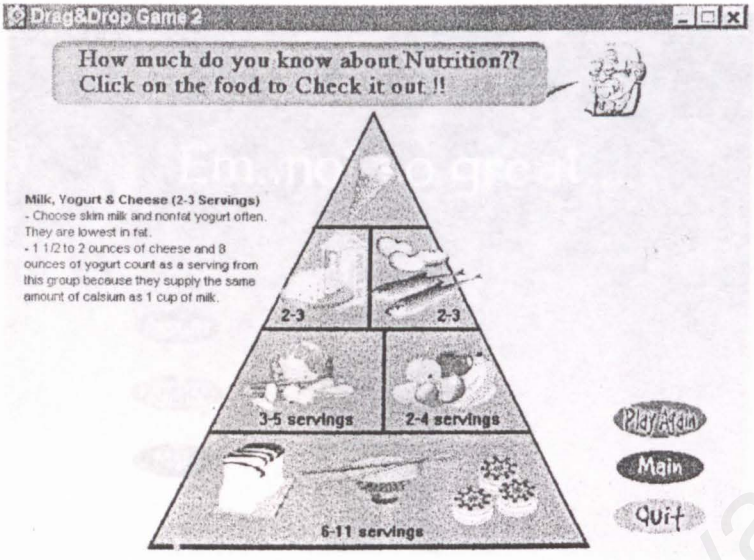



Figure 17: Drag and Drop Game 2 answer's interface

1. User can check their answer on this scene.
2. The "Play Again" button to restart the game.
3. The "Main" button to go to "FunScience" main interface.
4. The "Quit" button to exit the system.

3.13 Response for not good performance

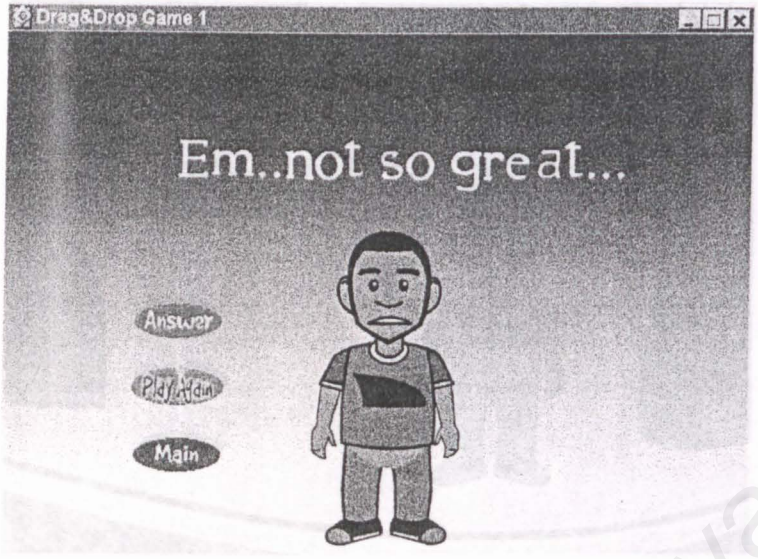



Figure 18: Response for not good performance

1. User will see this animated scene if their performance are not well in the both Drag and Drop Game 1 and 2.
2. The "Answer" button to show the answer given.
3. The "Play Again" button to restart the game.
4. The "Main" button to go to "FunScience" main interface.

3.14 Response for good performance

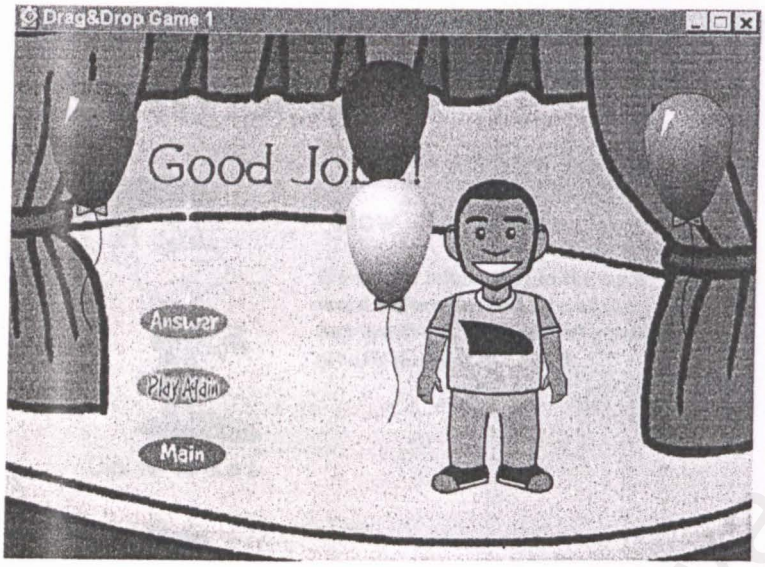



Figure 19: Response for good performance

1. User will see this animated scene if their performance are good in the both Drag and Drop Game 1 and 2.
2. The "Answer" button to show the answer given.
3. The "Play Again" button to restart the game.
4. The "Main" button to go to "FunScience" main interface.

3.15 Ready to play "LittleBoy" game (Guess a word Game)

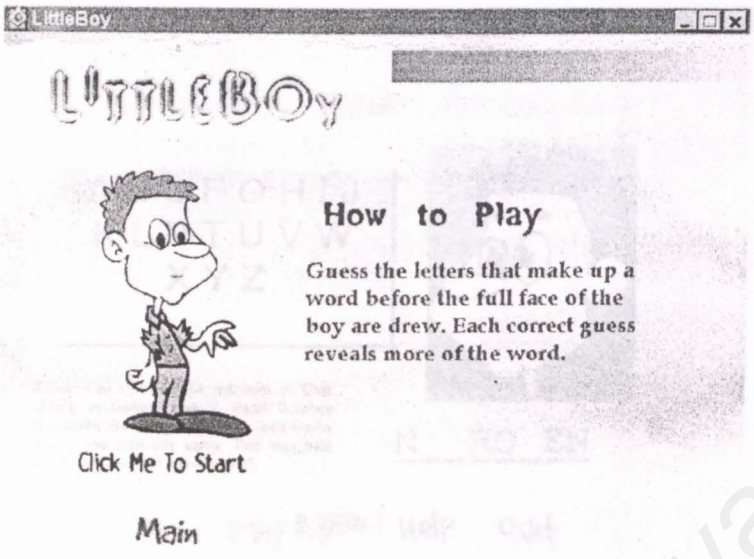



Figure 20: LittleBoy (Guess a word Game) interface

1. The instruction shows that how to play the game.
2. Click on the icon above the "Click me to start" to start the game.
3. Click on the "Main" button to go to "FunScience" main interface.

3.16 Playing the "LittleBoy" game (Guess a word Game)

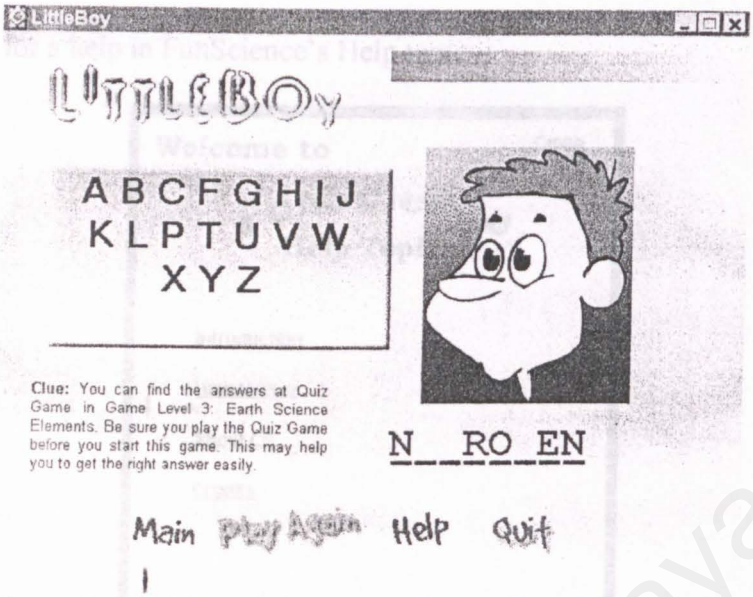



Figure 21: LittleBoy (Guess a word Game) content interface

1. User can find the answer easily after playing the Earth Science Elements Quiz Game.
2. Guess a letter that make up a word before the full face of the boy is drew. Each correct guess reveals more of the words.

## 4. Seek for help

4.1 Seek for a help in FunScience's Help topic

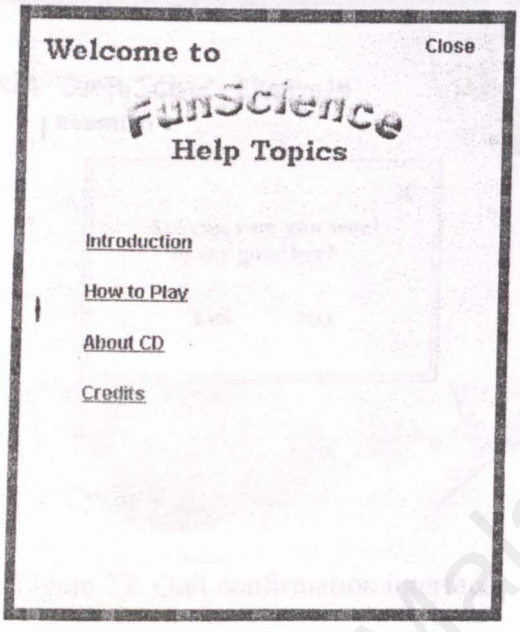



Figure 22: FunScience's Help topic interface

1. The four menus in FunScience's Help topic, which are Introduction, How to Play, About the CD and Credits.
2. Introduction: Briefly explain what is about the CD.
3. How to play: Describe how to play the games in "FunScience".
4. About CD: Explain how to overcome the Display Problems, Sound Problems, Memory Problems, Care of CD and CD-ROM drives.
5. Credits: Person who involves in this system.

## 5. Quit the Game

5.1 Are you sure you want to say good bye?

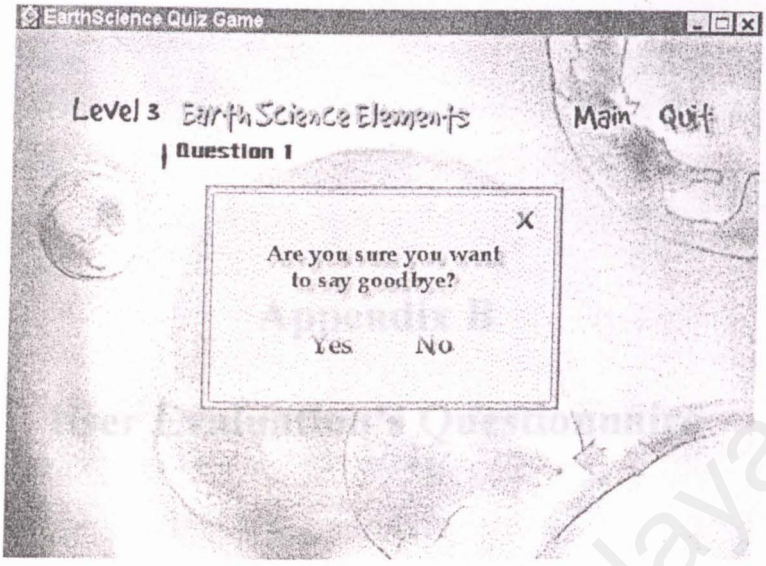



Figure 23: Quit confirmation interface

1. When user clicks the "Quit" button, the screen will pop up and confirm with the user whether they want to quit the game or not.
2. If user clicks the "Yes" button, the system will exit immediately.
3. If user clicks the "No" button, then the system will continue running.

# Appendix B

# User Evaluation's Questionnaire

# User Evaluation

The purposes of this survey are:

- To assess the effectiveness and the general outlook of the Maths and Scinece Educational games.
- To determine if this educational games system meets the users' need and expectations.

Please kindly take a moment off to complete the survey. Your co-operation is very much appreciated.

**User's detail**

Standard: Primary/Secondary/University/college Age: _____

1. The scope of the questions used in the games.
   - ☐ Very suitable
   - ☐ Suitable
   - ☐ Unsuitable
   - ☐ Very unsuitable

2. Level of difficulty is appropriate for the stated age/grade level.
   - ☐ Very suitable
   - ☐ Suitable
   - ☐ Unsuitable
   - ☐ Very unsuitable

3. The effectiveness on learning (knowledge gained) after used the system.
   - ☐ Very effectiveness
   - ☐ Effectiveness
   - ☐ Moderate
   - ☐ Ineffectiveness

4. The color combination of the user interface design.

- ☐ Very suitable
- ☐ Suitable
- ☐ Unsuitable
- ☐ Very unsuitable

5. The Educational Games layout design.

- ☐ Very attractive
- ☐ Attractive
- ☐ Unattractive
- ☐ Very unattractive

6. The interaction between each module in Science Educational Games.

- ☐ Very easy to navigate
- ☐ Easy to navigate
- ☐ Not easy to navigate
- ☐ Very difficult to navigate

7. User will be able to use program independently.

- ☐ Agree
- ☐ Somewhat agree
- ☐ Neutral
- ☐ Somewhat disagree
- ☐ Disagree

8. General attitude:

- ☐ Frustrated
- ☐ Bored
- ☐ Happy
- ☐ Indifferent

9. Things you liked:

- ☐ User interface design
- ☐ Ease of use
- ☐ Knowledge gained
- ☐ None

If others, please specify _____

10. Suggestion(s) to improve this Educational Games system:

_____

_____

_____

_____

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[2] Shari Lawrence Pfleeger, *Software Engineering Theory And Practice*, 2nd ed. Prentice Hall Inc, 2001

[3] Wilbert O.Galitz, The Essential Guide to User Interface Design, Wiley Computer Publishing


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2. Mohamad Noorman Masrek, Kamarulariffin Abdul Jalil, Safawi Abdul Rahman, *Analisis & Rekabentuk Sisten Maklumat*, McGraw-Hill (Malaysia) Sdn. Bhd., 2001.
3. Ralf Steinmetz, Klara Nahrstedt, *Multimedia: Computing, Communications and Applications*, Prentice Hall. Inc, 1995.
4. Sham Bhangal, *Foundation ActionScript*, Brad Lang


**Web Resources**


[U1] Games-to-Teach Research Vision
http://cms.mit.edu/games/education/research-vision.html

[U2] Multimedia Elements
http://ansel.his.duq.edu/~woytek/mm213/module3/intro.html

[U3] Authoring Systems
http://www.ee.uts.edu.au/~dinh/subject/hypermd/prj/intro.htm

[U4] Flash 5

http://home.pacific.net.sg/~conceptbox/

[U5] Programming Language

http://www.atis.org/tg2k/alldef2.html

[U6] Java

http://www.lkwdpl.org/classes/author/java.htm

[U7] JavaScript

http://www.webopedia.com/

[U8] Visual Basic

http://msp.sfsu.edu/instructors/jlevin/basic/vb_definition.htm

[U9] Introduction to Visual Basic Scripting

http://tech.irt.org/articles/js117/

[U10] FunBrain.com - The Internet's Education Site for K-8 Teachers and Kids

http://www.funbrain.com

[U11] Papert Excerpt

http://westy.jtwn.k12.pa.us/users/sja/Papert.html]

[U12] http://www.hcl.co.in/QA_Lab/qalab_methodology.htm

[U13] http://www.priorit.bizhosting.com/testing_glossary.html

[U14] http://www.aceproject.org/main/english/et/ete05c.htm

[U15] http://www.itmweb.com/methodology/methd09g.htm

[U16] http://www.aceproject.org/main/english/et/ete05.htm

**Other Related Sites**

1. KidsDomain.com

   http://www.kidsdomain.com

2. Multimedia Software and Language Learning

   http://www.kevinryan.com/research/mm.html

3. Vaille, John A. (1999) Nine Keys to Quality K-12 Online Learning Experiences.

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4. Macromedia Flash 5

   http://www.sonic.net/mnitepub/pccafe/reviews/macromedia_flash5/flash5.html

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6. Flash 5

   http://www.academac.co.il/sysfla.html